The Electrical Industry's Weekly Magazine

February 4, 1957

Electrical World

Price 35 Cents

A McGraw-Hill Publication

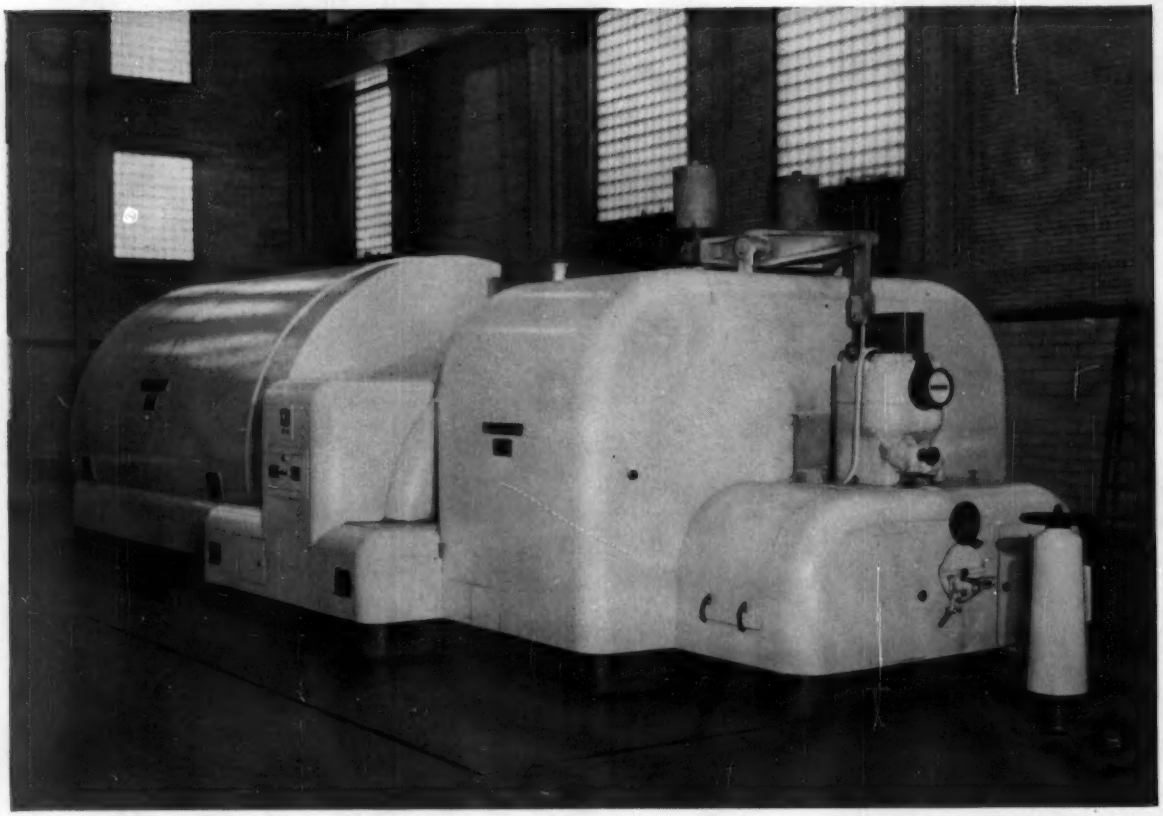
Britain EXPANDING Supergrid

... page 58

National Electrical Week Aims for Impact ... page 40

"There was no rust or sludge . . ."

● *In this plant (name on request) a Westinghouse 30,000 kw. generator was disassembled for a regular check-up. The superintendent reported on the performance of Texaco Regal Oil R&O—*



"We are extremely well pleased with the condition of this unit . . . *There was no rust or sludge . . . wear on the bearings was negligible.* All bearings will be put back into the unit just as they were removed. *Texaco Regal Oil R&O* has done a wonderful job . . ."

You'll get similar reports from operators everywhere who are using *Texaco Regal Oil R&O*. This is the famous oil that's refined to premium quality then further improved with special additives to prevent rust, sludge and foam. *Texaco Regal Oil R&O* has an extra long service life — gives you an extra margin of safety in the operation of your turbines.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all leading turbine builders. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Electrical World

Vol. 147, No. 5 Feb. 4, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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GENERATION

Many Items Affect Coal Handling

Quantity, frequency, and rate of flow are factors to be considered in selecting handling equipment.....p 61

Extinguishes Transformer Fires

Automatic spray system has 1,000-gal tank and water under hydrogen pressure at unattended substation.....p 57

TRANSMISSION

British Supergrid Still Growing

CEA schedules 1,500 miles for 1960 and an additional 1,700 miles thereafter.....p 59

MANAGEMENT

Costs Are Cardinal in Rate Design

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These Approaches Promote Private Power

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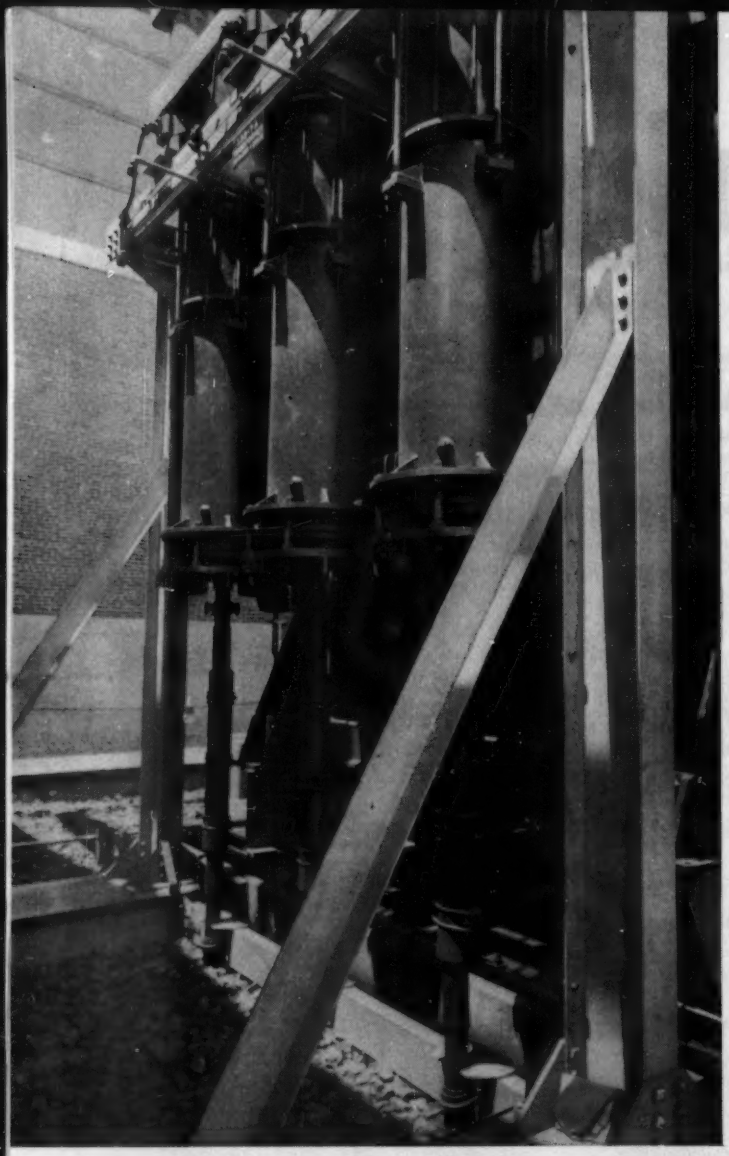

This 132kv Oilostatic system three phase termination direct to the high voltage side of the transformer eliminates exposed bus structures, bushings and potheads. The self-contained termination saves space and provides maximum safety because all "live" parts are enclosed.

Section of a typical Oilostatic system

Oilostatic transformer termination eliminates exposed bus structures

Advantages of a self-contained metal-clad transformer termination are evident from the photo at left. This neat, compact termination, being completely enclosed, insures maximum safety by eliminating exposed bus structures, bushings and potheads. Since 1949 this type of Oilostatic termination has been operating satisfactorily.

The installation shown is the termination of a 132kv Oilostatic system recently purchased by Public Service Electric and Gas Company of New Jersey. This system, *developed originally by Okonite*, consists of paper-insulated cables installed in a welded steel pipe filled with oil maintained at 200 psi.

Proof that Public Service Electric and Gas Company of New Jersey can expect to get outstanding performance from this installation is their previous experience with Oilostatic systems that date back to 1940. In addition, Oilostatic systems have been in successful operation elsewhere since 1932 and have recently been installed for operation at 230kv.

For information on Oilostatic systems, write for Bulletin EW-1044. Address: The Okonite Company, Passaic, N. J.

375

Available with either copper or aluminum conductors

where there's electrical power . . . there's **OKONITE CABLE**

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. . . *from the publisher*

As you would expect, all of us had our fingers crossed to see what the reaction would be to the new Electrical World. Trying to interpret the wishes of 26,000 readers is quite a risky operation. I guess it is something similar to changing the residential rates. We just have to do the best we can, after putting in many, many hours of research and study, in planning an editorial diet that the majority of our customers will think well of.

Well, so far, nobody has complained to the Public Utility Commission, and the newspapers haven't damned us. Of course, they weren't involved in our case but even better no one has written a damning letter to our bosses. In fact we have some wonderful compliments. One veteran subscriber of 34 years had this to say about the new Electrical World. "The publisher and his staff are to be congratulated on the many improvements that have been made. Electrical World has consistently progressed with the needs of the industry, but this new face lifting is most outstanding."

Another one of our good readers adds. "Those innovations, format, etc. come along like a breath of fresh air. More power to you." Another one: "A good cover for the NEW Electrical World." And still another: "It surely is easier to read, better looking, and I'll bet will pay out in greater style than ever."

You may be sure that these are reassuring comments. It is our sincere wish that you all agree and that you will get greater pleasure out of reading Electrical World in the future.

Fischer Black

ELECTRICAL WORLD

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Now Balanced Design in Allis-Chalmers

Engineered
to provide all the advantages you want and need

In the *balanced design* of Allis-Chalmers power transformers, each feature complements the others to provide outstanding dependability and long transformer life.

High Impulse Strength — Coil assemblies are designed to withstand repeated lightning and switching voltage surges without damage to the transformer.

Corona-Free Design — Keeps transformers young. Full insulation strength is maintained because transformer parts are kept free of corona's injurious effects.

Quiet Operation — Constant research in transformer noise has led to reduced sound levels in Allis-Chalmers transformers.

Reduced Size and Weight — Substantial reductions in height and weight simplify installation and relocation. Larger units can be shipped completely assembled.

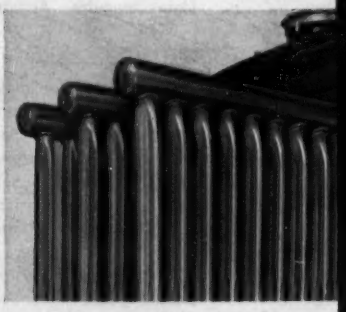
High Short-Circuit Strength — In Allis-Chalmers transformers, circular coils are preshrunk and rigidly braced to withstand short-circuit conditions. Careful electrical balance of windings minimizes mechanical forces.

Get the complete "balanced design" story from your Allis-Chalmers representative. With a vast background of application engineering experience at his disposal, he will be glad to discuss transformer problems with you. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Mechanical Strength...

One of the Many "Engineered-Together" Features of A-C Small and Medium Power Transformers

Side frame design locks core and coil assembly firmly to protect against short-circuit forces. Machine-wound insulating tubes provide rigid support for leads.



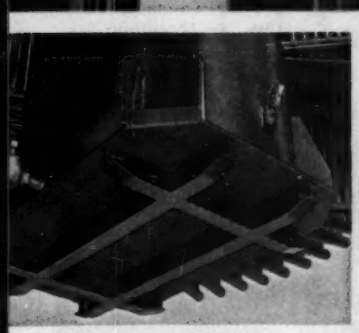
Radiator assembly is welded into tank wall to provide neat appearance and strong construction. Gasket maintenance is eliminated.

NATIONAL ELECTRICAL Week
FEB. 10-16, 1957

LIVE BETTER ELECTRICALLY

ALLIS-

Power Transformers



New base combines strength with utility. Heavy I-beam supports are turned upward at ends to allow sliding or rolling of transformer in any direction.

A-C CHALMERS

A-C ALLIS-CHALMERS

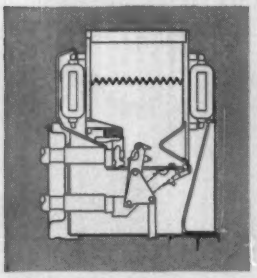
A-5149

METAL-CLAD SWITCHGEAR

BETTER PROTECTION AGAINST HIGH CURRENT FAULTS

uniform flux density across whole arc chute

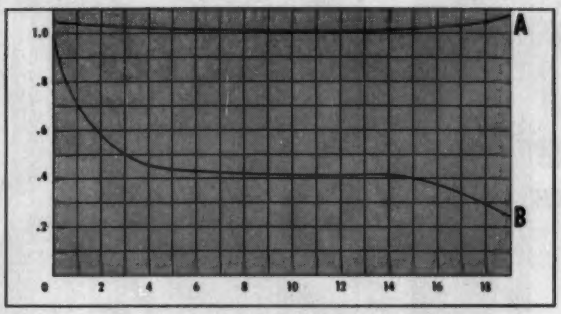
When a high current fault opens an I-T-E 15 kv circuit breaker, the arc is practically swallowed up in the arc chute—faster and over a longer path than has ever before been possible. The reason lies in two unique construction features found only in I-T-E circuit breakers:



Path of arc through chute equipped with twin coils.

1. Twin coils and closed loop magnet. Arc current through the twin blowout coils develops a stronger flux density that is uniform across the entire arc chute. Arc is stretched farther, faster—cooled and extinguished in less time. And the forward part of the arc chute comes into use just as much as the back part. So arc chute life is significantly prolonged.

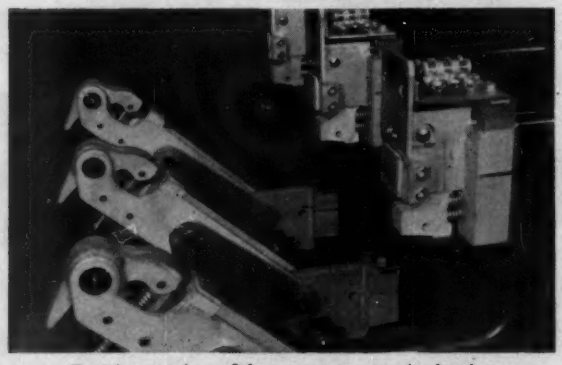
2. Laminated iron of transformer quality. This superior iron construction keeps losses to a minimum. Magnetic field is not only stronger, but rises and falls in phase with the current through the arc. Thus the greatest magnetic pull on the arc occurs when it is most needed—at the top of the current cycles. These are both extra-quality construction features of the sort you can expect to find in I-T-E switchgear. All together,



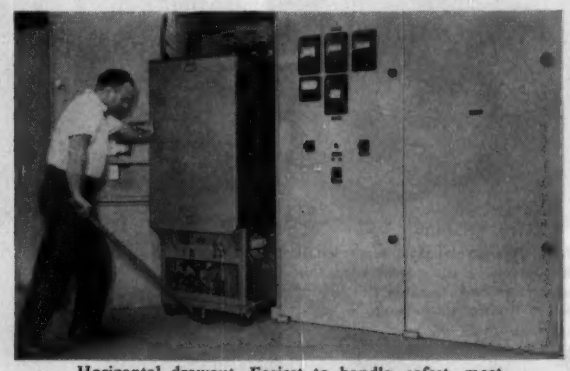
Flux density across entire length of arc chute.
A. Twin coil B. Single coil

I-T-E quality means generally superior performance, better endurance under handling, and longer life in service. Yet it costs you no more.

Get complete information on I-T-E metal-clad switchgear—and the many engineering services available to help you realize greater economy and satisfaction in a system that meets your requirements. Available in ratings from 2.3 through 13.8 kv, 50 through 750 mva interrupting, and up to 3000 amperes continuous. Write to I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.



Fast interruption of low current arcs. As breaker opens, pistons force a jet of air between contact points—driving arc up into arc chute.



Horizontal drawout. Easiest to handle, safest, most convenient assembly known. So strong that switchgear is shipped factory assembled and ready for installation.

I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division

TWIN COILS
CLOSED MAGNET LOOP
Laminated Iron
of Transformer Quality
I-T-E

GENERAL CABLE'S HIGH QUALITY CONTROL CABLE with

To preserve the superior physical characteristics inherent in black neoprene, General Cable applies a colored synthetic rubber base coating supplemented, where necessary, by spiral striping over the black neoprene jacket of individual conductors.

This new, carefully developed method of color coding the individual conductors of multiple conductor cable results in superior quality, brighter colors and an extra tough coating for permanence.

Station, Traffic, Elevator and Railway control cables are color coded in accordance with IPCEA Standard color sequence and to customer's specifications.

GENERAL CABLE CORPORATION,
420 Lexington Avenue,
New York 17, N. Y.
Offices and Distribution Centers
Coast-to-Coast.

for quality and service . . . specify **GENERAL CABLE**

About the finer points of metering:

Sangamo J2 Meters ...safety-packed in re-useable cartons

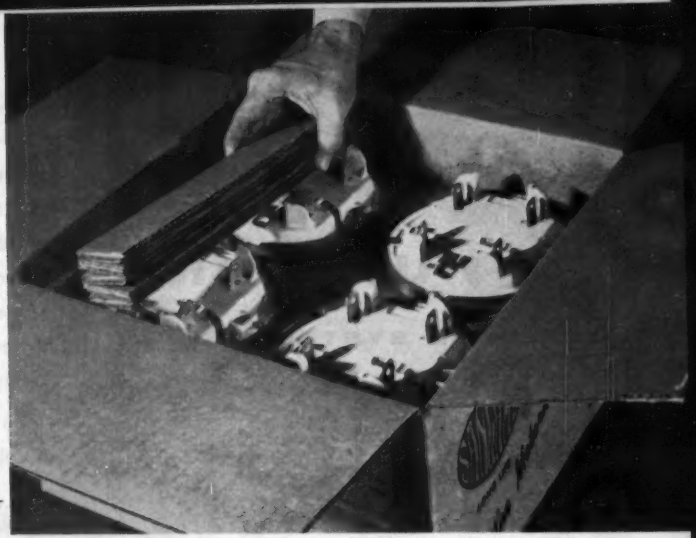
Sangamo J2 Watthour Meters are shipped to you in re-useable cartons that are scientifically engineered to maintain accurate factory calibration of the meters during shipment. J2 Meters, which are shipped sealed, arrive ready for use. They can be put on your lines, as received, without adjustment. Meters are fully protected against damage by the "floating method" of packaging. No part of any meter touches the sides, top or bottom of the outer carton.

Many power companies re-use these sturdy cartons, again and again, on their line trucks. Specify Sangamo J2 Meters—calibrated, sealed, and packaged for unimpaired accuracy.

SANGAMO ELECTRIC COMPANY

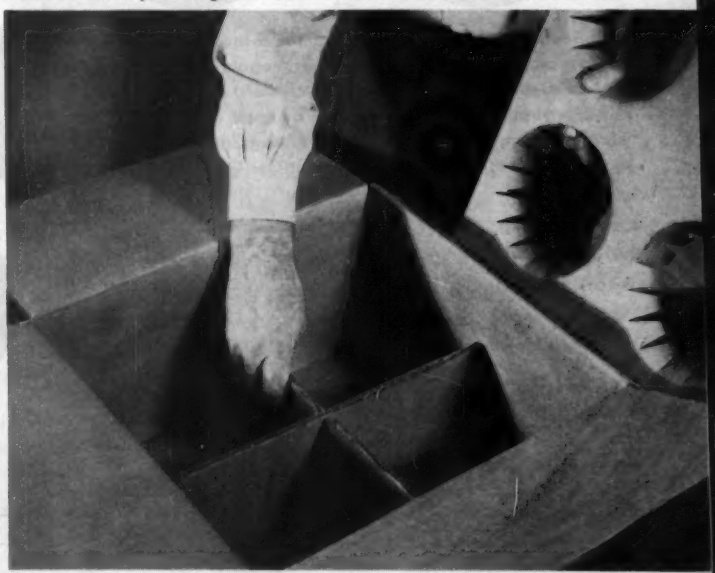
SPRINGFIELD, ILLINOIS

JH57-1



350 lb. test outer carton has double-protected top and bottom. Drop tests and shipping tests prove that the outer carton must be ruptured before meters can be damaged.

Specially designed die cut tray cradles meters in suspended position so that no part of glass covers touch the bottom or sides of case.



Cross brace partitions divide case into separate compartments for each meter and provide firm support for the die cut tray.

HOW MUCH PUNCHING

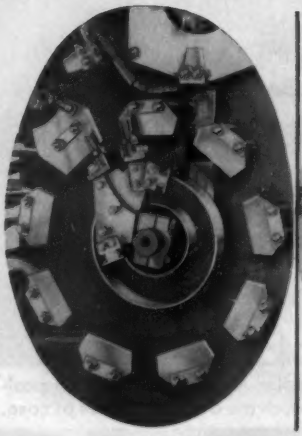
CAN YOUR SYSTEM STAND?

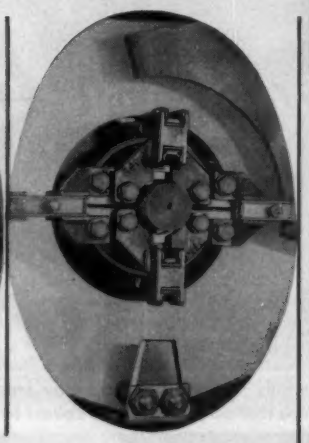
(Utility System, that is)

It's literally true that every time a switch is flicked, or a button punched, your system (utility) takes the brunt of it. Of course this adds up to greater power consumption which is desirable, but it also puts quite a strain on voltage regulation throughout your system.

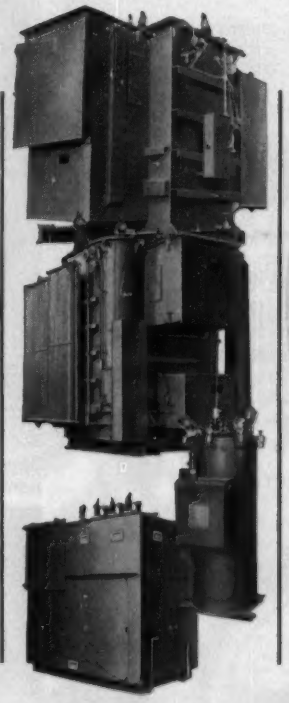
When power demand peaks and ebbs rapidly, be sure that your regulating points are manned by equipment that is able to take it and continue to operate efficiently, smoothly and dependably. In other words, install Moloney Load Tap Changing equipment because . . .

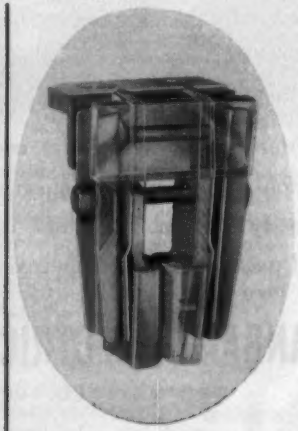
MES6-33





Moloney's exclusive by-pass reactor principal—used for all Kva and voltage ratings—permits regulation of voltage *without* arcing at Tap Selector Switch (left) because *all* current interrupting duty is performed by Load Transfer Switch (right). Arcing at Load Transfer Switch is minimized by a reactor in parallel with the Load Transfer Switch.





Contacts used for current interrupting duty are tipped with a high arc-resistant, copper-tungsten alloy to minimize arc deterioration and maintenance costs.

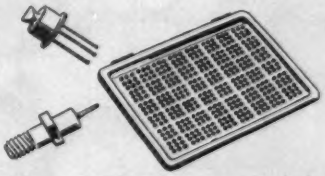
MOLONEY ELECTRIC COMPANY

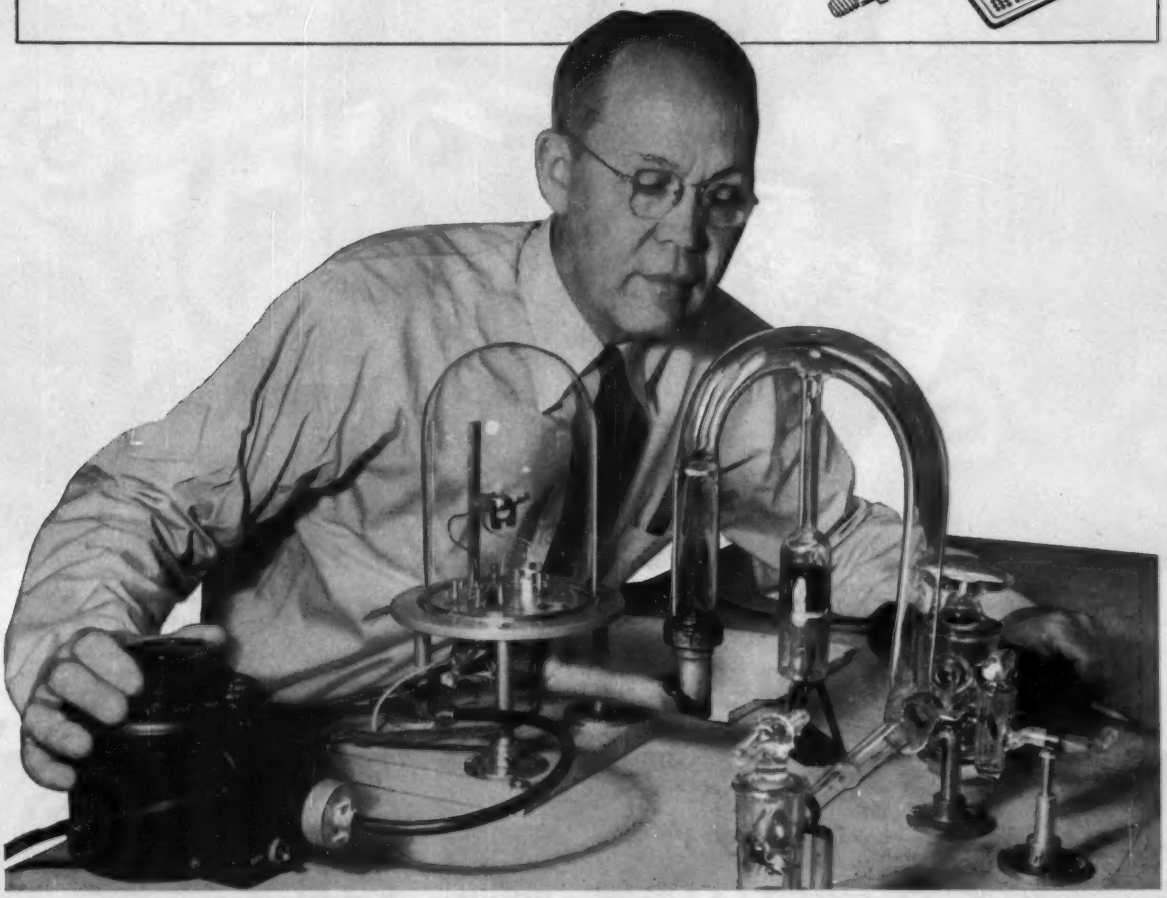
Power Transformers • Distribution Transformers • Load Tap Changing Transformers
Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers
Industrial Dry Type Transformers • Capacitors • Transformers and Inductors for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

New technique shapes future of transistors...

LEADS TO THREE MAJOR INVENTIONS





Calvin S. Fuller, Ph.D. in Physical Chemistry from the University of Chicago, is a pioneer in development of the diffusion technique. Here he controls a heating current through a strip of silicon while diffusing into its surface a film of aluminum less than 1/50th of a hair's breadth in thickness.

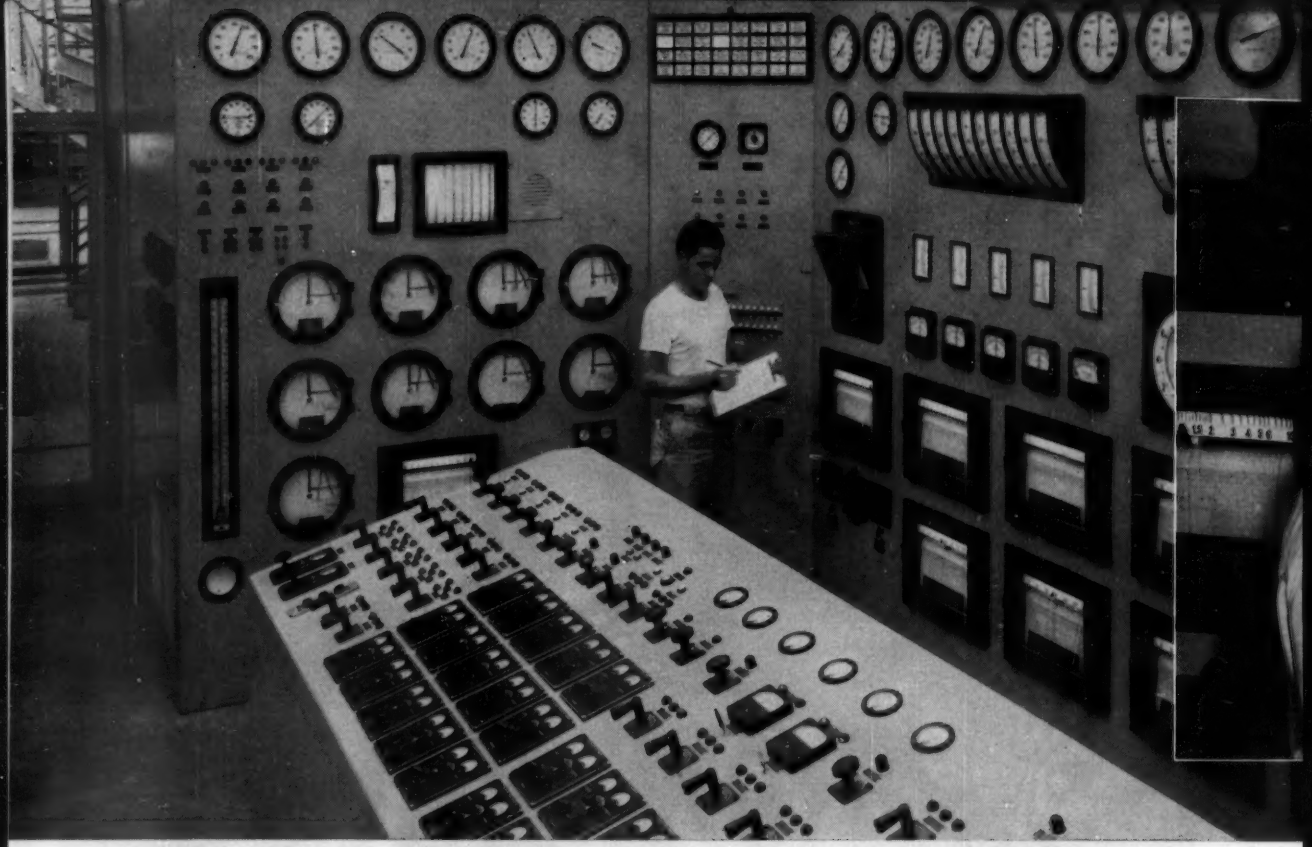
Transistor makers have a very difficult problem. They must add a mere trace of an "impurity" to a semiconducting metal. But they must add it only in very thin layers, without affecting the bulk of the material.

Bell Laboratories scientists developed an efficient new way to produce such layers. They expose the metal to a hot gas containing the impurity. Atoms bombard the surface and—through a process known as "diffusion"—force their way into the metal to form a microscopic film which can be controlled in thickness to a few millionths of an inch.

The diffusion technique opened the way to three major Bell Laboratories inventions in the semiconductor field: the Bell Solar Battery, Silicon Power Rectifier and the Diffused Base Transistor. Right now the technique is providing a key to many other developments of great promise for telephony. It is another example of how Bell Labs works to improve telephony through fundamental research in materials.

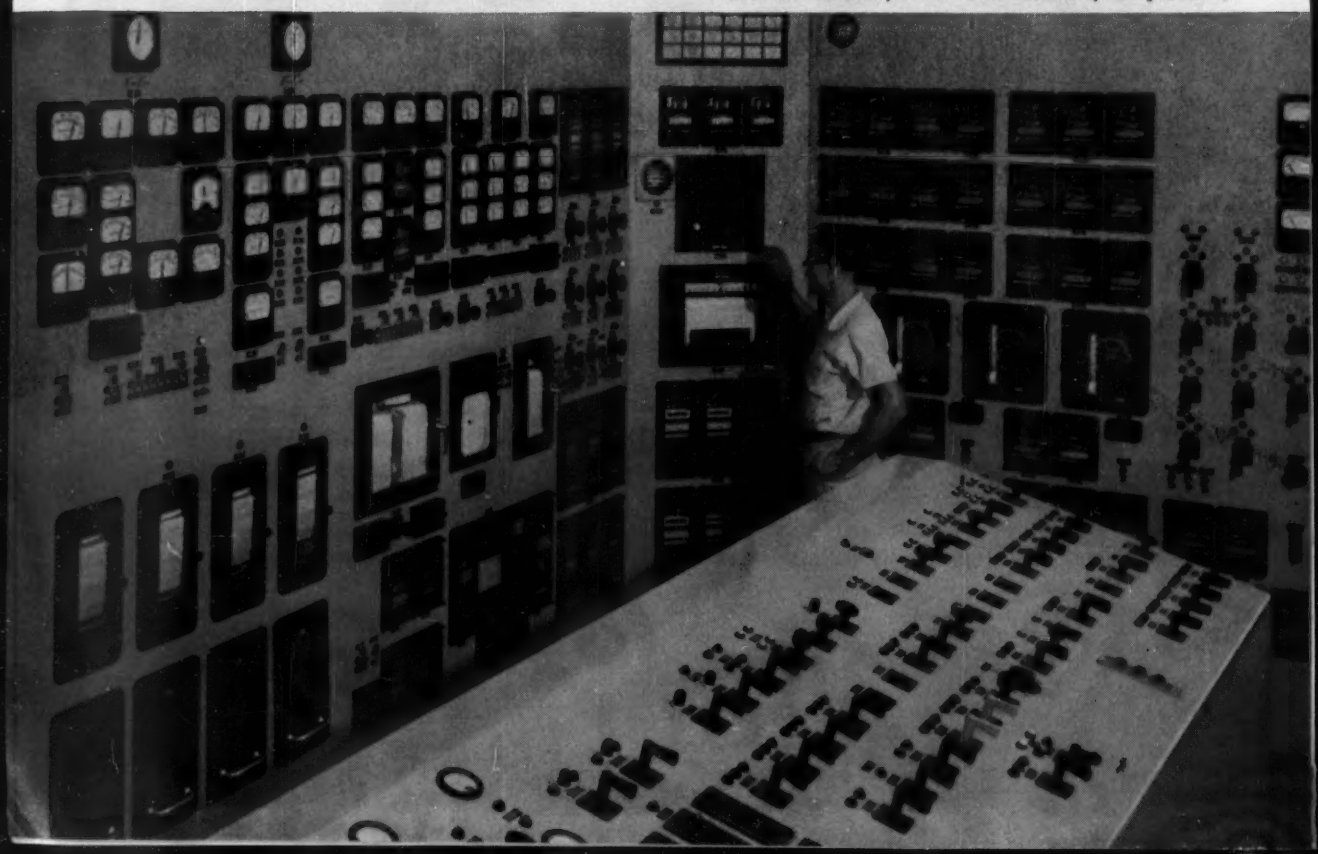
BELL TELEPHONE LABORATORIES

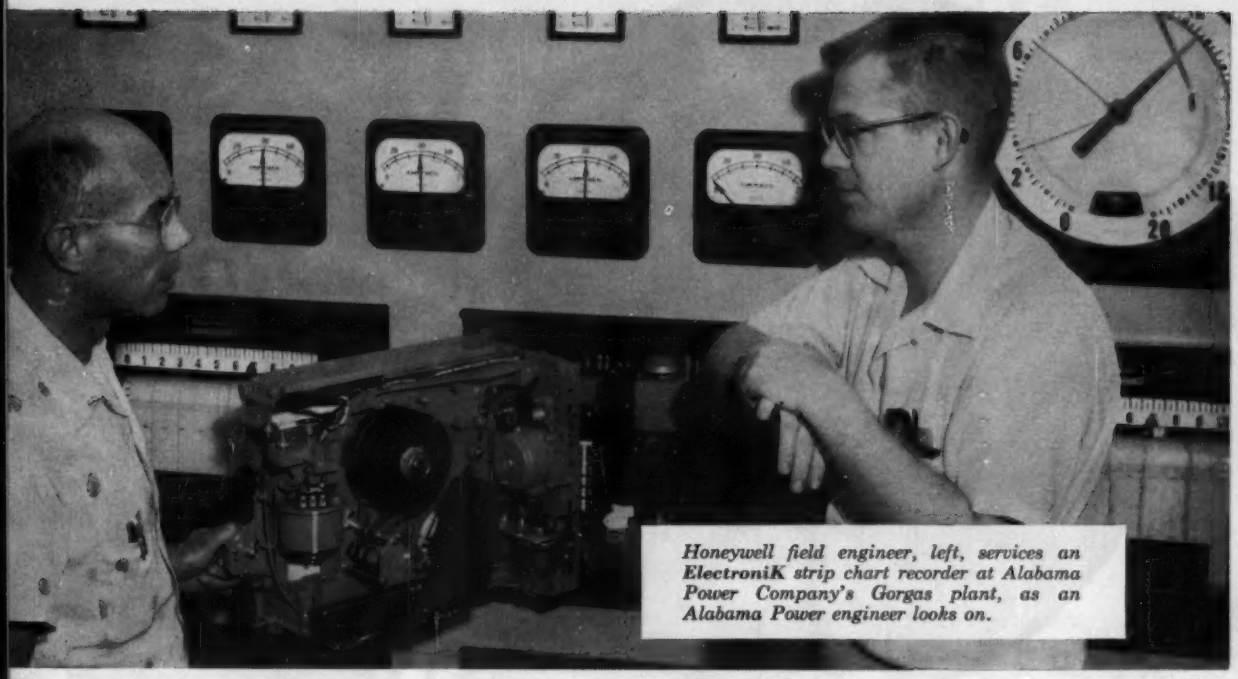
WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



Controls for the turbine section of the plant are mounted on this side of the control room. ▲

This side of the central control room at the Gorgas plant houses instruments for the boiler section of the plant. ▼





Honeywell field engineer, left, services an ElectroniK strip chart recorder at Alabama Power Company's Gorgas plant, as an Alabama Power engineer looks on.

Alabama Power Company relies on Honeywell instrumentation and service

Alabama Power Company gains major advantages through use of Honeywell instrumentation at its Gorgas Steam Plant near Birmingham. One of these is dependable, accurate control over both boiler and turbine sections. The Gorgas plant is Alabama Power's first installation to combine instrumentation for both sections in a central control room.

Equally important is the unmatched Honeywell service. Here, as in other installations, field engineers from the local Honeywell branch office provided service assistance at startup. And, should emergencies develop, service from Honeywell usually arrives in less than 24 hours after a call . . . anywhere in the U.S.

You, too, have much to gain from the proved reliability of Honeywell instrumentation and complete service follow-through. Your nearby Honeywell sales engineer will gladly provide full details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

H HONEYWELL

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

The most beautiful money in the world...
is made for you by Honeylite !

HONEYLITE *combines maximum efficiency with maximum beauty.*

HONEYLITE *is easier to install.*

HONEYLITE *is suitable for every application. UL approved.*

Used in full ceiling lighting, in recessed troffers and in all types of lighting fixtures, HONEYLITE transmits the most light with the lowest surface brightness.

HONEYLITE may be used in all types of T-bar suspension systems. Because of its low weight (2 oz. per sq. ft.) and inherent acoustical properties, HONEYLITE requires a far less complicated suspension system than any other light diffusing material.

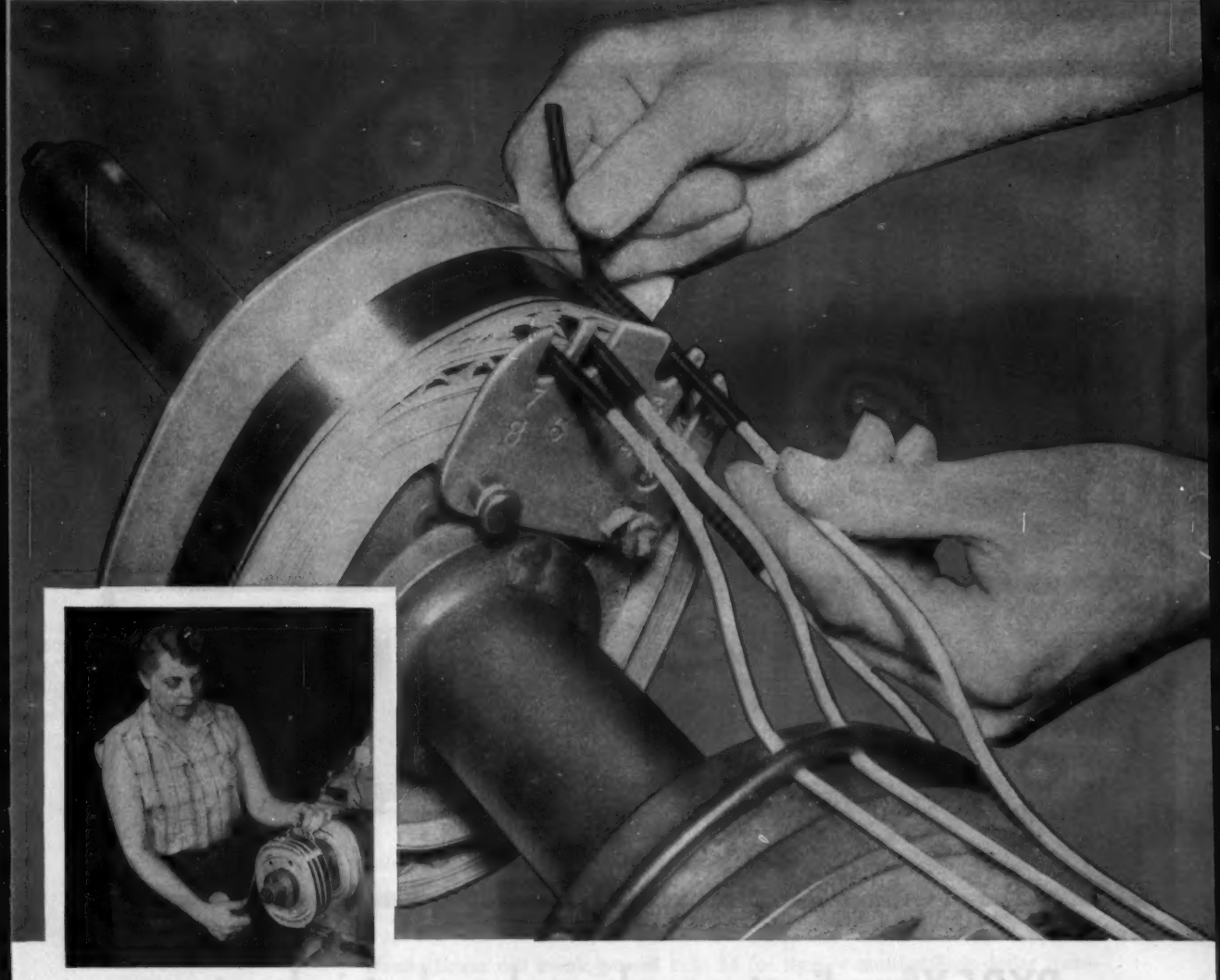
HONEYLITE can be incorporated in any lighting installation — suspended louvreall ceilings, troffer diffusers, industrial and commercial fixtures.

For price lists and detailed information see your local distributor or write to Dept. EC, Hexcel Products, Inc., 951-61st Street, Oakland 8, California.

HONEYLITE*

LIGHT-DIFFUSING ALUMINUM HONEYCOMB

A development of **HEXCEL PRODUCTS INC.**



She's tapping through five metal fingers to position each POLE STAR lead

The method of positioning high voltage tap leads typifies the degree of accuracy called for in the production of Pole Star distribution transformers. The experienced and highly skilled winding machine operators undoubtedly could bring out the taps with almost perfect accuracy with no mechanical aids. Because there *is* a possibility of error, however, all high voltage tap and line leads are precisely located with metal templates, as shown above. Thus, there can be no slight variations to complicate later assembly or place unnecessary strain on connections.

Similar production-control methods are used in other stages of Pole Star coil production. Windings are accurately positioned between the folded edges of kraft layer insulation . . . heavy, low voltage leads are prebent to the desired radius on a jig, then are clamped in position during winding . . . adjustable devices permit the proper wire tension to be maintained throughout the winding, assuring a "tight" construction.

All of these things mean greater coil uniformity — a major factor in the outstanding dependability for which Pennsylvania's Pole Star distribution transformers are noted from coast to coast.

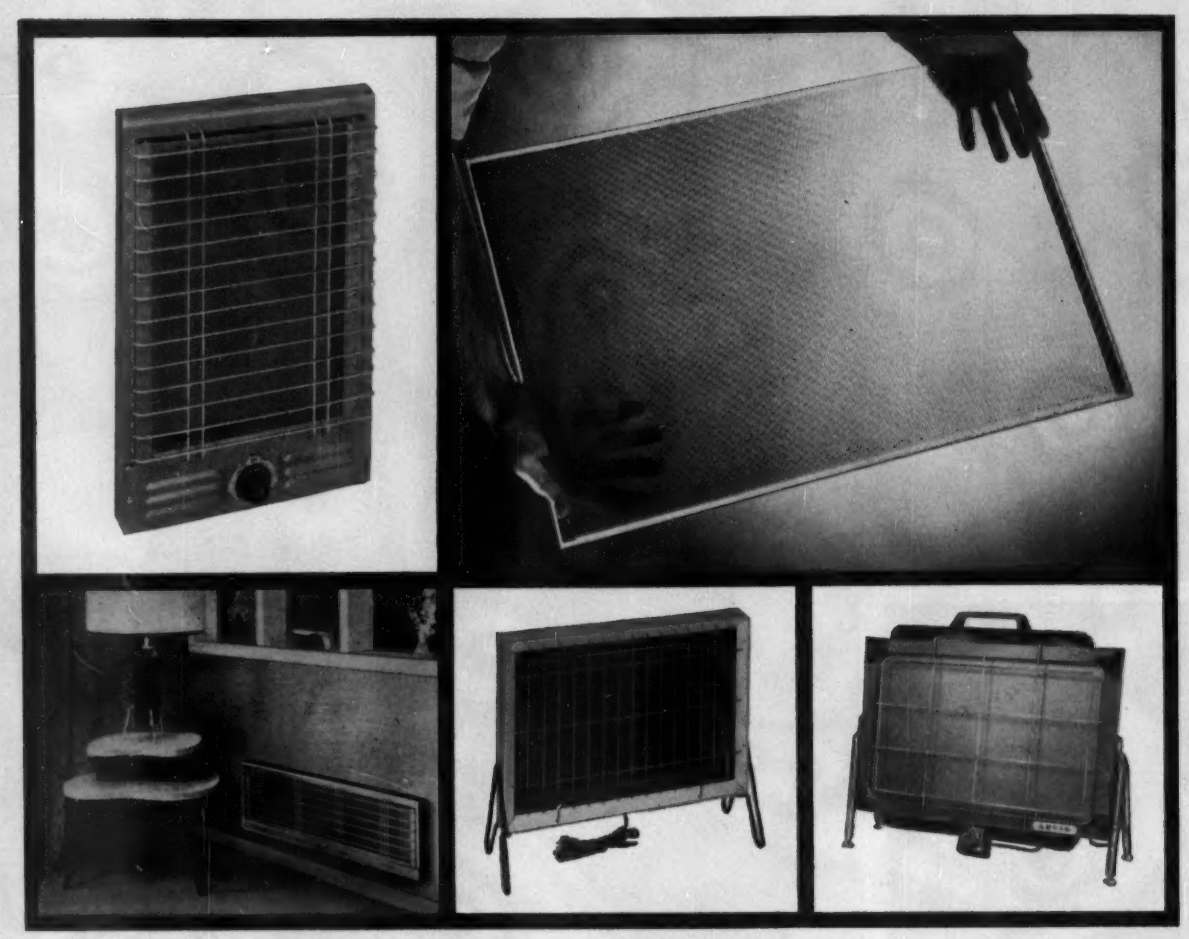
167 Production Controls make Pole Star Best!

3 through 500 kva, through 67,000 volts

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

pt POLE STAR



PYREX® radiant panels make electric heat economically sound . . . *now*

New high-output electric space heaters, equipped with PYREX brand radiant panels, are making electric home-heating economically sound now, even in many areas where rates *seemed* to place it in the future.

Built-ins, and portables for supplementary heating, offer high wattages. This is possible because PYREX panels are of a tempered borosilicate glass that can pack up to 3,000 watts per unit. The need for fewer panels reduces the initial cost of an installation.

Other economies—Because no chimney, ducting or piping is needed, the cost of a PYREX radiant panel installation is equal to, or below that of most conventional heating systems. Utilization of living space—formerly earmarked for heating equipment, is also an economic gain.

The PYREX radiant panel carries a history of proven success in many types of portable space heaters, permanent domestic heating systems and in industrial heating and drying applications.

It enables you to offer your customers the comfort, convenience and cleanliness of electric heat plus these other attractive features:

1. **Safety.** No glowing wires or coils.
2. **Fast, uniform heat.** Infrared rays convert to warmth fast. The entire surface of the PYREX panel radiates heat.
3. **Comfort control.** Every room can have the amount of heat it needs right to the degree.
4. **Silence.** No moving parts.
5. **Space saving.** A unit need be only 2 to 3 inches deep.
6. **Economy.** Savings in construction and installation make electrical heating more practical.
7. **Reliability.** The well-known PYREX trademark identifies dependable values.

Now you can get complete heating systems in many designs. And you can install PYREX radiant panel systems in every heating installation with complete assurance of dependable performance.

Write for more detailed information on the characteristics and advantages PYREX panels offer you.

Corning means research in Glass

CORNING GLASS WORKS
39-2 CRYSTAL STREET • CORNING, NEW YORK

NEWS-SCOPE

FUTURE NEWS ▶

Another midwest group of utility executives (EW, Jan. 21, p 35) **are meeting to consider a new reactor concept** that might possibly be used for A-power plant.

Look for Secretary of Treasury George M. Humphrey to support partnership program for hydro projects and oppose new project authorizations.

An eight member Special Senate Committee on Labor Racketeering will be appointed soon, headed by Sen J. L. McClellan (D-Ark.). It may look into union expenditures for support of public power organizations in Pacific Northwest.

Watch for Democrats in charge of the Joint Atomic Energy Committee to get the labor unions off the hook in the Power Reactor Development case. If unions fail to steer current AEC hearings to AEC's allegedly illegal action in issuing construction permit, JAEC will hold its own hearing on the matter.

LATE NEWS ▶

Utilities are getting their long-awaited winter peaks. Record outputs, unusual for January, are reported by TVA, BPA, Consolidated Edison, Pacific P&L, and Portland General Electric, among others. (See issue of Jan. 14, p 44).

Washington Wire . . . Good prospect to fill forthcoming vacancy on TVA Board is Edward F. Mynatt, assistant general counsel for credit and conservation in Agriculture Dept. If named, he would replace Dr Harry Curtis, whose term expires this spring . . . **New FPC secretary** is Joseph H. Gutride, former staff member . . . **Rep Thomas A. Jenkins (R-Ohio) will fill vacancy** on Joint Atomic Energy Committee left by the death of Rep Carl Hinshaw.

After stormy sessions, California legislature okays $25-million appropriation bill for highway relocation in Oroville dam and power plant area. The action helps pave way for construction of giant $1.5-billion Feather River project.

Westinghouse will break ground Feb. 26 for its new multi-million dollar transformer plant at Athens, Ga. . . . **Dividend of 95¢ a share** has been declared by Westinghouse board of directors on 3.80% Series B preferred stock, and 50¢ a share on common. Both are payable Mar. 1 to stockholders of record Feb. 11.

New 600,000-kw steam plant, with facilities for docking modern super-tankers, is planned by Montaup Electric (Mass.). Located on Taunton River above hurricane flood levels, the $120-million plant will start operating in 1964.

REA borrowers will spend $806.1 million for construction between 1957-61. Major expenditures, reveals second annual survey, will be $248.6 million for distribution lines; $244.1 million for system improvements; and $158.1 million for generation . . . **REA Administrator David A. Hamil urges** all co-ops to add Science-Youth Day (see p 41) to National Electrical Week activities.

Federal Power Commission has issued 50-year license to Portland General Electric for proposed $13.3 million project in Clackamas County, Oregon.

White Weld & Co submits best bid of 18½¢ a share to underwrite Ohio Edison Co's 580,613 common share offering. (See p 101).

Congratulations . . . Recently named members of EEI's Technical Appraisal Task Force on Nuclear Power are R. F. Bacher, California Institute of Technology; M. W. Boyer, Standard Oil (N. J.); A. B. Kinzel, Union Carbide & Carbon; H. D. Smyth, Princeton Univ.; and H. A. Winne, General Electric.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▶ **National Electrical Week (Feb. 10-16) is "reaching down to the grass roots** everywhere," says NEW Chairman Merrill E. Skinner. It'll be an occasion for promoting the electric way of life, and utilities, manufacturers, dealers, and contractors are joining together to make it a week to remember **(p 40)**. . . . The week starts off with added attractions—National Edison Birthday Celebration and National Science Youth Day, both scheduled for Feb. 11 **(p 41).**

WASHINGTON ▶ **New York Republicans, for the first time, are united on a Niagara power bill.** They favor state development and the state "preference clause" which gives priority in purchase of power to rural and domestic consumers. Democrats in Congress are still pushing for a federal preference clause which favors publicly-owned systems **(p 42).**

ATOMIC PROGRESS ▶ **Offers of up to $50-million liability coverage** per commercial atomic plant are in the offing from the insurance industry **(p 44).**

GENERATION ▶ **Best time to select your mobile coal moving equipment** is during the design stages of a steam station. This enables you to integrate both the fixed and mobile equipment to obtain the lowest overall unit costs. Quantity of coal handled and frequency of rate of flow are controlling factors. You'll find a thorough discussion of the advantages of various types of mobile coal handling equipment to cope with different storage and reclamation demands **(p 61).**

Shoot foam lather into a condenser tube and you'll find it easy to detect leaks. Los Angeles Dept of Water & Power has developed a dispenser especially for this job and is asking for a patent **(p 72).**

TRANSMISSION ▶ **Britain's pushed-up supergrid construction will add 1,500 miles of 275-kv,** 50-cps line by 1960. Another 1,700 miles of interconnections and bulk transmission circuit will be added later. The reason: Maximum national demand is expected to jump from 1950-51 total of 13,000 Mw to 70,000 Mw by 1980-81. About half the country's capacity in 1975 will be atom-fired. The 275-kv choice affords about six times 132-kv capacity, has lower voltage drop, and will help save $14 million a year, says the Central Electricity Authority **(p 58).**

Concrete counterweights for balancing crossarms on 69-kv transmission lines are being used by Salt River Power District. The 200-lb weights will be used until additional insulators are added to boost line voltage to 161-kv **(p 68).**

Fireproof "pants" for transmission poles along the edge of a Minnesota swamp are put on by Northern States Power Co. These aluminum sheets deflect heat to resist the grass fires that often hit the swamp section **(p 68).**

DISTRIBUTION ▶ **Novel portable interrupter switch** for breaking the circuit at capacitor installations is used by Dayton P&L. The interrupter tool, on a switch stick, bypasses the current from the fuse tube of the open-type cutout, then breaks the arc in a cloud champer. It eliminates need for interrupter switches **(p 74).**

Stiff-leg, maple gin-stick helps Worcester County (Mass.) Electric Co crews raise capacitor banks by lessening sway and guiding them past lines on pole. They'll take up to 2,500-lb. Photo and drawing are included **(p 66).**

SUBSTATIONS ▶ **Fire protection for an unattended substation** on the Philadelphia Electric system is provided by water stored in a pressure vessel and discharged by bottled nitrogen. Maximum discharge time for 1,000 gal of water in the installation is two minutes. Tests indicate that most fires are put out in 10 to 45 sec **(p 56).**

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

SELLING ▶ **The ladies have plenty to say about what they want** in the way of kitchens and electrical appliances. Con Edison of New York found out the hard way—by going out and questioning some 1,500 of its women customers. It found **women want larger kitchens, more light, electric rather than gas ranges, larger refrigerators and more freezer space,** and lots of other electric equipment. Perhaps a similar survey in your area would put a more solid foundation under appliance and adequate wiring promotion programs **(p 76)** . . . New heat pump designed for home builder market is now available **(p 78).**

An adjustable voltage motor drive system cuts power and maintenance costs for a new iron ore unloader at Mobile, Ala. Small rotating amplifier generates an adjustable d-c voltage to control trolley and bucket motors, eliminating large contactors and accelerating resistors with inherently large I^2R losses **(p 80).**

MANAGEMENT ▶ **Rising costs, the tight money market, and changing load patterns** focus increasing attention on rate of return and the electric rate structures that influence it. **It's vitally important to make sure that incremental business is bearing its proportionate share of the service costs.** These costs, writes H. F. G. Main, rate engineer, Potomac Electric Power Co, are an important guide-post in the proper design of a rate. He presents a concise discussion of the various methods of allocating these costs to customer classes and emphasizes the value of load research in rate design, particularly in the residential and small commercial fields. Here's an article aimed at utilities which are worried with soaring summer peaks **(p 51).**

Wyoming legislature studies bill which would prohibit utilities from merchandising appliances . . . Idaho legislature considers bill to exempt certain industries from energy tax . . . Pennsylvania P&L won't appeal rate cuts ordered last year . . . Florida P&L will raise rates 5½% to cover fuel cost increases . . . Wisconsin PS Co will reduce rates $315,000 a year . . . Florida tax study urges that electric rates of municipally-owned systems be sufficient to cover amount of property taxes that a private company would have to pay . . . Southwestern Public Service Co trains non technical men to advance in engineering **(p 101).**

PEOPLE ▶ **E. A. Paine is named superintendent of distribution at Portland** General Electric Co . . . Arthur D. Caskey becomes assistant manager of engineering for Commonwealth Edison Co . . . Robert S. Quig is in charge of Ebasco Service's rate department **(p 108).**

MANUFACTURERS ▶ **Three radically new type 115 kv, 400 amp, 1,000 Mva circuit breakers** using sulphur hexafluoride to break the arc are now being tested at Gulf Power Co. Its reported the gas "soaks" up electrons just as a sponge soaks up water. Initial costs at this point run higher than for existing breaker designs . . . A. B. Chance Co contracts to buy American Crossarm & Conduit Co with closing to come within a month . . . Truck shipment of a completely assembled 115-kv, 800-amp, 1,500-Mva breaker was made to a New England company **(p 95).**

NEW EQUIPMENT ▶ **New type single-phase, pole-type voltage regulator** is reported to cover a range of plus or minus 10% in 32 steps of ⅝% each. It can operate at 160% of rated current when externally adjustable limit switches are reset to cut range to plus or minus 5%. Motor-driven tap changer and the core and coil assembly are suspended from cover **(p 82)** . . . Recently introduced construction truck body has a 29-ft derrick that can handle poles up to 65 ft. Self-storing jacks are used to support rear or to level truck. A 3-kw a-c generator, driven by the truck engine, supplies power for flood lights or auxiliary tools. A hydraulic digger bores vertical or angular holes with diameters up to 22 inches **(p 82).**

ENGINEERING TRENDS

Vertically-mounted disconnects can provide space and dollar economy for substations operating at voltages above 138 kv as they have for lower-voltage stations when switches are re-designed to keep the insulator stacks in vertical position. Further modification even places the contact jaw on the rigid bus to avoid the complexity of supporting it on an additional insulator stack in an awkward position. Full use of this new type of switch mounting is claimed to save 35% in substation areas.

Carrier-current relaying transfer-trips BPA 287-kv line successfully through line faults in 1 to 2½ cycles. Equipment functions, also, to clear transformer troubles. Additional installations are proposed for lines up to 345 kv.

Automatic economic dispatch saves $23,000 per year for Kansas City P&L Co, according to information revealed at last week's AIEE conference. Actual savings fall short of theoretical $68,000 but are adequate to justify $170,000 expenditure for the installation. Full achievement of theoretical value is considered improbable on any system.

Valuable ideas are available for the asking to people who listen. Success claimed for "brainstorming" by a Mid-western utility proves that contributions should be solicited from people in many walks of life—not only those who are expected to know the answers.

Distribution may need additional budget appropriations before the year is out. Tapering off of factory expansion by 30% in the fourth quarter for most of the U.S., as now predicted, could leave utilities with unprofitable, high capacity reserves and spur them to renewed load-building activities.

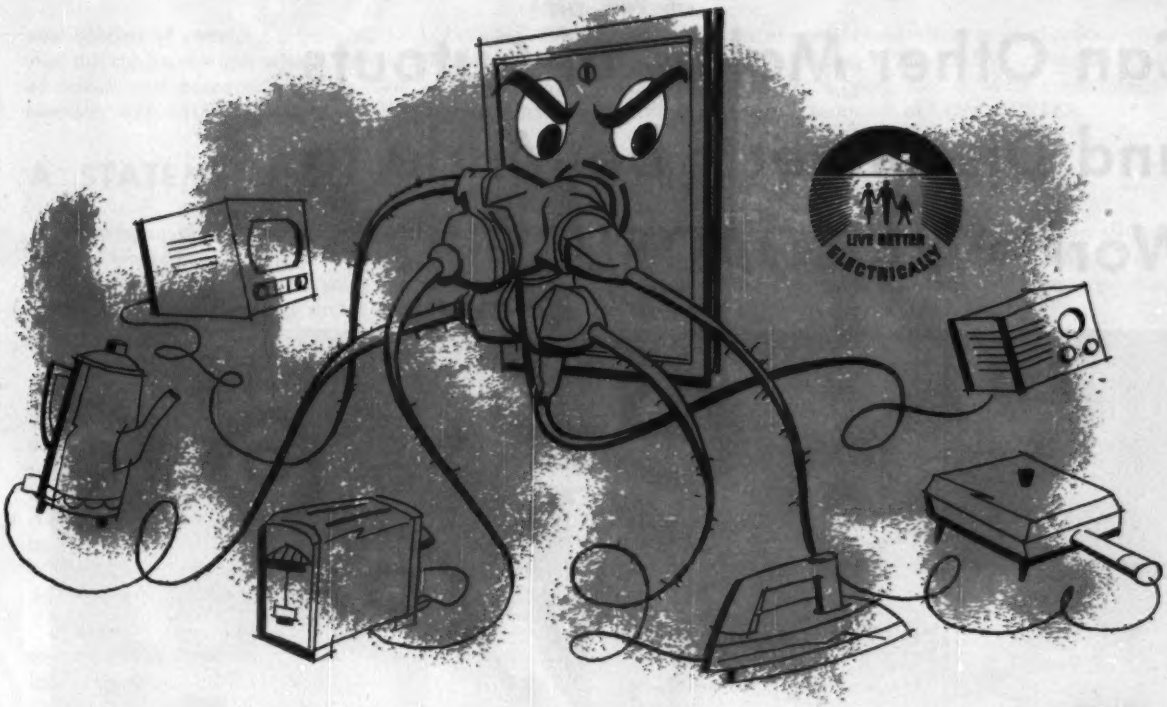
FROM EDITORS IN THE FIELD

Country homes will have transformers in basement garage vaults for service from the 12.5-kv, rear-property, open-wire primaries in the plan devised by a Southwestern utility to serve 2-to-4-acre homesites carved from a large estate.

Wishbone configuration of short 115-kv lines saves 12% as compared with H-frame construction. Carolina P&L Co finds that the cheaper construction assists rights-of-way acquisition because it requires only a 50-ft width instead of 70. And use of a flying tap to bring the ground lead down from the shield wire maintains the same impulse level as is achieved with H-frames.

Switching cost is cut for 23-kv Y-connected capacitor banks by using small 15-kv oil circuit breakers in the neutral leads. Installation at this point minimizes voltage stress on the breakers. Overcurrent protection for the banks is provided by fuses on the line side. Carolina P&L Co has applied this protection and switching to seven 600-kvar platform installations.

All new distribution will be at 12 kv for a large Mid-western utility.



Going octopus hunting?

O-B insulators, hardware make effective weapons in raising housepower

As electrical living becomes more and more popular, the "octopus" outlet, symbol of inadequate wiring, will join the potbellied stove in extinction.

Adequately wired, power-hungry homes require more distribution capacity. Is your distribution system, for example, prepared to handle the average annual load of eight thousand kw-hr per customer expected by 1970?

As you go ahead with expanding your distribution system, it's both reassuring and convenient to know that the O-B insulation and hardware required for your octopus hunt are available from Graybar. Reassuring because you'll get products of uniformly high quality, from a company that designs and makes both insulators and hardware. Convenient because Graybar can quickly provide just what you need for distribution construction or modernization.

Your Graybar house delivers O-B products where and when you need them, in any quantity you desire.

OHIO BRASS COMPANY, MANSFIELD, OHIO

ADVERTISEMENT

Can Other Makes of Cutouts and Disconnects be Made to Work with LOADBUSTER?

The Answer Is "Yes, But-"

A STATEMENT TO THE ELECTRIC UTILITIES:

You've told us that you want LOADBUSTER, S&C's portable loadbreak tool, to be "universal" so you can use this safe, convenient, economical tool for load switching up and down your distribution feeders, no matter whose cutouts and disconnects are in service, or whose you may want to buy.

Your position is well taken. Long ago, we realized it would be desirable to have LOADBUSTER usable with various makes of cutouts and disconnects. We've tried to keep this in mind in all our subsequent development work. With this being an objective, LOADBUSTER has been designed along straight-forward, functional lines. But this went only part way. The next step involves redesigning cutouts and disconnects to accommodate it.

Adapting cutouts and disconnects for use with LOADBUSTER is not a simple matter. While field improvisations can render certain existing makes operable to a limited extent with LOADBUSTER, such adaptations have restrictions as to electrical application and manipulation capability.

Even design modifications applied by the manufacturers themselves to current production models will provide a less-than-ideal degree of workability with LOADBUSTER. Truly satisfactory results can be achieved only after complete redesign.

Naturally, we at S&C cannot and should not undertake to work out—or even advise on—the details of the various redesigns that may be attempted. That is the province of the individual manufacturers. We are, however, now presenting specific data on the opposite page as to minimum requirements that must be met for completely adequate and safe performance with LOADBUSTER.

Of course, S&C's Type XS Cutout and new Tool Operated Disconnect meet these requirements, since they were expressly designed to operate with LOADBUSTER.

We're publishing these performance requirements for two reasons: (1) The electric power industry is entitled to realize the greatest possible benefits from the revolutionary

new concept of switching introduced by LOADBUSTER. And this can happen only when a number of different makes of cutouts and disconnects are available which will work correctly with LOADBUSTER. (2) Every effort possible must be made to prevent inadvertent misapplications which could lead to difficulties in field usage, difficulties which might create hazards to personnel, or which might interfere with the proper performance of LOADBUSTER.

A STATEMENT TO MANUFACTURERS:

Following up on our "Statement to the Electric Utilities" on the opposite page, we are providing the following information for your guidance in designing or redesigning cutouts or disconnects for operation with LOADBUSTER, S&C's portable loadbreak tool.

Basically, what's required is an attachment hook at the upper (jaw) end of the cutout or disconnect, over which the anchor on the end of LOADBUSTER can be hooked; plus a pull ring on the fuse tube or disconnect blade located so that it can be readily engaged by the pull-ring hook of the tool. The physical arrangement of these features, however, is of utmost importance. Specifically, the following requirements must be met to permit the maximum practical use of LOADBUSTER while insuring the greatest safety to line personnel and to the circuits involved:

1. The combination of LOADBUSTER and the cutout or disconnect must be so coordinated electrically and mechanically that when LOADBUSTER is at the point of tripping, sufficient disconnect gap between all live parts of the combination is obtained to secure the minimum 60 cycle, dry, withstand voltage values shown in Column III, and to meet the dimensional requirements, Column IV, of the accompanying table. These requirements must be met even with LOADBUSTER in the most unfavorable position possible (i.e., the one which will produce the smallest external disconnect gap at time of tripping).

2. The cutout or disconnect design must be such that the gap values shown in Column V of the table are attained with LOADBUSTER fully extended, thus allowing its removal from the attachment hook of the cutout or disconnect without reducing the disconnect gap of the combination below the value shown in Column IV. In the case of disconnects, provision must be made for subsequent complete opening of the blade, prior to disengagement of LOADBUSTER from the pull ring of the blade.

3. The cutout or disconnect must be capable of easy, positive manipulation with LOADBUSTER from all practical angles and directions, for all mounting positions intended for the device, without danger of violating the minimum electrical requirements given above.

4. The sequencing control built into LOADBUSTER must be protected. For example, engagement of the tool must not cause the fuse tube or blade to drop open prematurely. Also, the attachment hook must keep the tool positively anchored until time of tripping, but must allow easy removal of LOADBUSTER, whether the operating cycle has been completed, or whether, for any reason, the cutout or disconnect has been reclosed after partial opening.

Quantitative Requirements for Cutouts and Disconnects Qualifying for Use with Loadbuster

I	II	III[a]	IV[d]	V[e]
Disconnect Rating	Cutout Rating	Min. Withstand Voltage across External Disconnect Gap[b] at Time of Tripping[c]	Min. External Disconnect Gap[b] Separation at Time of Tripping	Min. External Gap[b] Separation with LOADBUSTER Fully Extended to "Latched Open" Position
Kv	Kv	60 Cycle, Dry, Kv, Rms	Inches	Inches
—	5	21	3	4
7.2	7.5	31[f]	3½[f]	4½[f]
14.4	15	35	3⅞	5

a—These values must be attained when tested with cutout hanger or switch base—and the hinge—grounded.

b—Between all live parts of the combination of LOADBUSTER and cutout or disconnect for most unfavorable position of LOADBUSTER.

c—To simulate the "time of tripping" condition, telescope LOADBUSTER 1⅞ inches from its "latched open" position.

d—These minimum dimensions, required to withstand recovery voltage and to provide the gap values shown in Column V for safe subsequent removal of LOADBUSTER, are based on designs where sharp points, sharp edges, protrusions, etc., are avoided so that essentially rod gap configuration is obtained on switch or cutout contacts. Sharp points, edges, etc., may require minimum gaps measuring as much as 25% greater than the dimensions shown to achieve the same dry withstand values.

e—These dimensions provide for designs in which LOADBUSTER can be removed without reducing the gap below values listed in Column IV which in turn exceed those which would generally be necessary to achieve withstand values required at time of removal of LOADBUSTER, an allowance having been included for possible careless manipulation.

f—These values allow for application of 7.5 kv cutouts at three-phase connections on 12.5 kv grounded wye systems.

LOADBUSTER, S&C's patented portable loadbreak tool, is an entirely new idea in circuit switching, one that provides, at low cost, complete, positive, safe switching for electrical distribution systems.

Disconnects and cutouts inherently have no positive switching capability. To get it, some interrupting means must be built into them. This costs money!!! BUT, bringing the interrupting device to the disconnect or cutout only when needed eliminates this cost . . . that's what LOADBUSTER does.

Attached to a universal pole, LOADBUSTER is simply hooked across the upper contact of a disconnect or cutout which is then opened in the normal way. It's just that easy! There's no arc, no link breakage, no contact burning, and no danger to the operator.

Designed to withstand daily field usage over a long period of time without requiring maintenance, LOADBUSTER is operable at any distribution system voltage through 14,400 volts, and can break all load currents through 400 amperes, as well as associated magnetizing and line charging currents. It can also switch all pole-top capacitor banks.

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

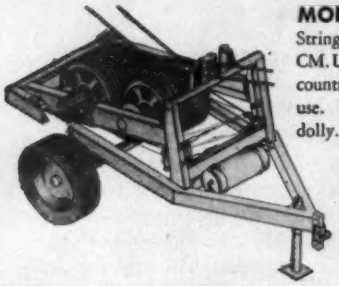
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Partial showing of the now ***COMPLETE*** line of . . .

PENGO TENSION WIRE STRINGING EQUIPMENT

Manufactured by **PETERSEN ENGINEERING CO.,** ***Santa Clara, Calif.*** **14 Patents Pending**

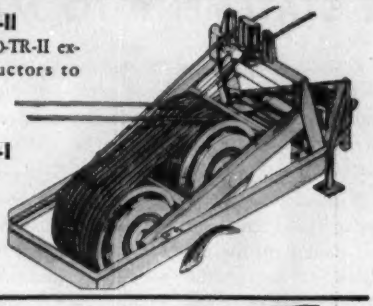


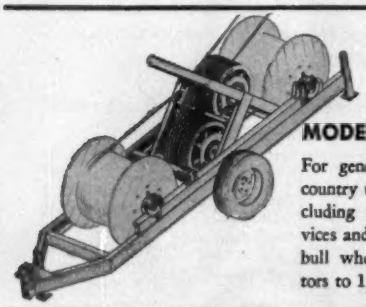
MODEL 5000-TR-II
Strings two conductors to 556,300 CM. Used primarily for very rough country work; also for general use. Use separate reel-carrying dolly.

MODEL 5000-TR-I
Similar except strings one conductor.

MODEL 6000-TR-II
Similar to Model 5000-TR-II except larger. Conductors to 1,272,000 CM.

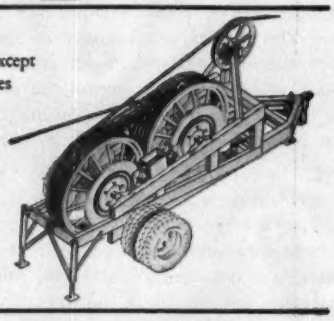
MODEL 6000-TR-I
Similar except for one conductor.

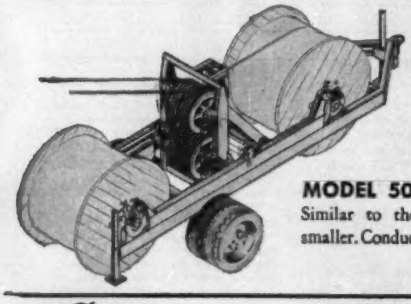




MODEL 6000-WS-TR
For general and medium rough country use. A complete unit including trailer, reel-carrying devices and its own double pair of bull wheels. Conductors to 1,272,000 CM.

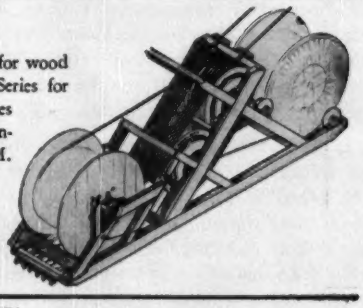
MODEL 7000-TR-I
Similar to model 6000-TR-I except larger. Conductors to 2 inches diameter.

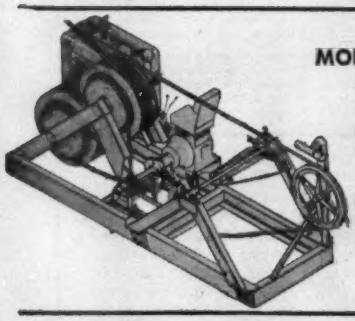




MODEL 5000-WS-TR
Similar to the 6000-WS-TR but smaller. Conductors to 556,300 CM.

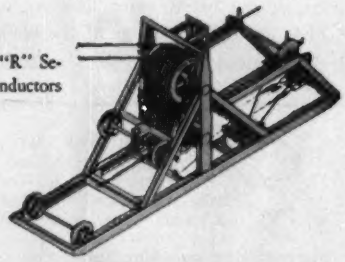
MODEL 6000-W
Available in "S" Series for wood or steel reels, in "R" Series for steel reels, or "SR" Series for trailer mounting. Conductors to 1,272,000 CM.

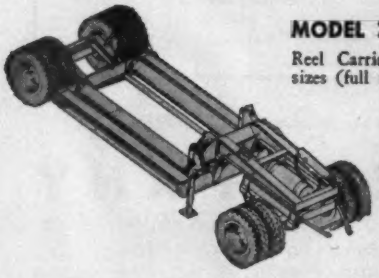




MODEL 6500
Bull Wheel Cable Puller. Available in "R" Series for steel reels, "S" Series for wood reels. Conductors to 1,272,000 CM. Also available in "LWR" Model for extra-large steel reels. Model 5500 similar (smaller).

MODEL 5000-SR
Available in "S" Series, "R" Series, or "SR" Series. Conductors to 556,300 CM.





MODEL 7500
Reel Carrier. Takes the largest sizes (full range) of steel reels. Loads and unloads with one man. No auxiliary equipment needed except the truck that pulls it. For use with any one of the tensioning machines shown on this page.

ADDITIONAL MODELS NOT SHOWN

Tension Reel Trailers

MODELS 2, 3, and 4, Two-Wheel Straddle Dollies not shown. For use with any one of the tensioning machines shown on these pages.

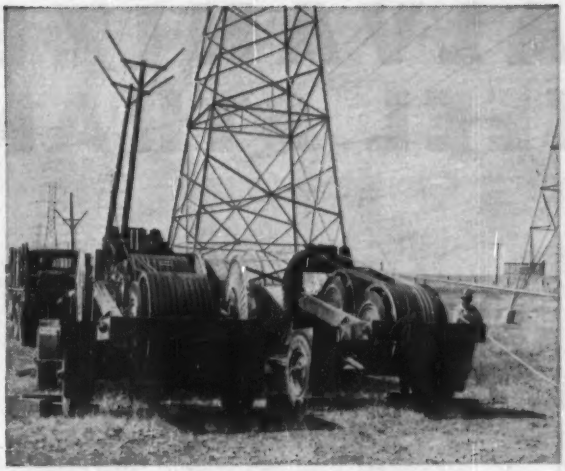
Tension Stringers

MODELS 6000-SK-I and 6000-SK-II For one or two conductors to 1,272,000 CM. Skid mounted for installation on owner's equipment.

MODELS 5000-SK-I and 5000-SK-II Skid mounted for installing on owner's equipment. For stringing one or two conductors to 556,300 CM.

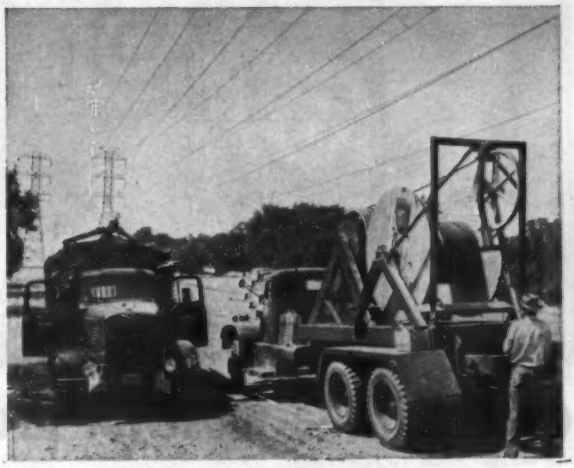
MODEL 5000-WS-III Strings three conductors to 556,300 CM. For mounting on low-bed or full trailer.

MODEL 6000-WS-III Strings three conductors to 1,272,000 CM. For mounting on low-bed or full trailer.



Two PENGO model 6000 TR-II wire tensioners being used by Pacific Gas and Electric Co. in reconductoring job between Vacaville, Calif. and Cottonwood, Calif. 285 miles of 500 MCM copper is being replaced by 954 MCM aluminum in this operation.

Newest method of stringing overhead lines



Two PENGO model 6500 Bullwheel Cable Pullers used by Pacific Gas and Electric Co. for pulling in the new line on the job mentioned above. Unit, manned by an operator and one reel tender, pulls the pulling line (in this instance the old copper conductor) over the double neoprene lined Bullwheels and winds it for shipment in a single operation.

- ***Safest, most economical way of stringing transmission, distribution and even secondary lines.***
- ***Its greatest savings are effected when stringing over and through energized circuits . . . by far the safest, too!***
- ***14 Patents pending.***

Smooth, positive control of conductor tension can be maintained at all times regardless of model or size of PENGO tensioning equipment used. The large, specially designed PENGO disc brakes are mounted away from the Bullwheels to assure dissipation of the heat generated by the continuous braking action and prevent transmission of the heat to the Bullwheels.

Note the wide range of models on the opposite page available for all types of jobs or terrain and for all sizes of conductor.

List your requirements and send for descriptive literature and prices.

Made by the makers of the World-Famous
PENGO EARTH AUGERS

PETERSEN
ENGINEERING COMPANY
Santa Clara, Calif.

PETERSEN ENGINEERING CO.
Santa Clara, California Dept. 4

Please send me more information on the new Pengo wire stringing equipment.

Name_____

Firm_____

Address_____

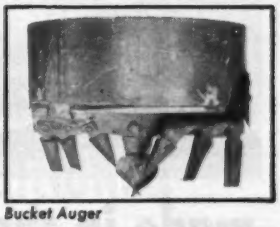
City_____ State_____

Other PENGO Products include:

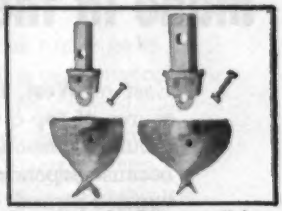
24 inch Heavy Duty Flight Auger

Double-Helix Heavy Duty Auger

Offset Boring Head

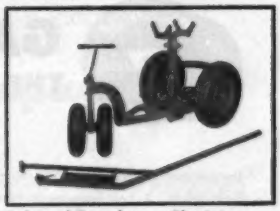


Bucket Auger



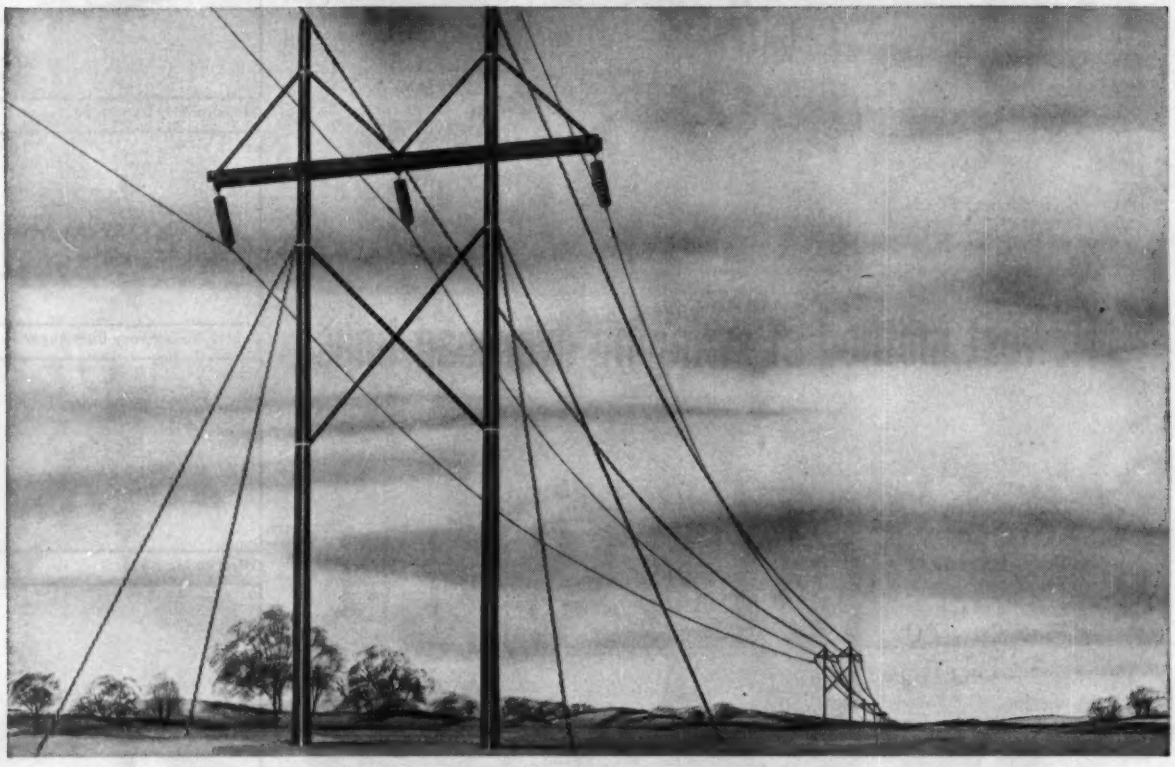
Screw Bit for Small Diameter Holes

Pulling Eye



Pole and Transformer Chariot

GALVANIZED STEEL STRAND



made in the east and the west for prompt delivery

East or West, there's a single, convenient source of top-quality galvanized strand for ground, messenger and guy wire. That's because dependable time-proved CF&I Galvanized Strand* is produced at both Buffalo, N. Y., and Pueblo, Colorado.

This combination of plant sites enables CF&I to quickly and efficiently fill your strand requirements.

What's more, you're always sure of the quality of CF&I Galvanized Strand. Every phase of its production is handled by the makers of world-renowned Wickwire Wire Rope and Wire Rope Slings...every phase of its production is under CF&I's rigid quality control system.

Next time you need strand—whether it's to ASTM Specification A-122, A-363 or your specification—it'll pay you to contact the closest CF&I sales office listed below.

*three- and seven-wire constructions

WICKWIRE A CF&I PRODUCT

GALVANIZED STEEL STRAND

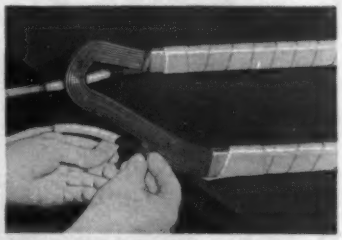
THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Kansas City Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City San Francisco • Seattle • Spokane • Wichita • CF&I OFFICES IN CANADA: Toronto • Montreal

4247

LOOK BEHIND THE "INSULATION CURTAIN" BEFORE YOU SELECT A LARGE MOTOR

What happens to coil insulation under these conditions?



ONE OF THE LITTLE THINGS THAT MAKES A BIG DIFFERENCE IN ELLIOTT COIL INSULATION. A special plastic is inserted where the lead leaves the coil to seal against entry of moisture or contaminants. Fine workmanship plus the most modern materials make Elliott coil insulation tops for large motors.

RG-13

● All the laboratory tests, claims and trick names go by the board when a motor goes on the job. It is performance that counts! This is especially so when it's an outdoor installation where fog, hail, snow, rain, dust, sand or chemical fumes give coil insulation the "full treatment". Elliott weather-protected squirrel-cage induction motors have stood this test. *Not one case of stator failure due to insulation trouble* has been heard of since 1948 when Elliott first developed its special coil insulation process. This is the record of 500,000 hp of weather-protected motors installed all over the world serving utilities and industrial plants of all kinds. It is performance that no "laboratory test alone" can prove. It is evidence you can trust when you select a large motor. You don't take a chance on insulation when you *specify* an Elliott Motor. Elliott Company, Ridgway Division, Ridgway, Pa.

ELLIOTT Company

Elliott large motor insulation is "field-proven"

For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC

PLENTY OF TACK—LOOK AT THE 'TEETH'

NO PINHOLES

SPEEDS THE JOB

STRONG FABRIC WRAPS TIGHT

BEST BUY FOR PLANT SUPPLY

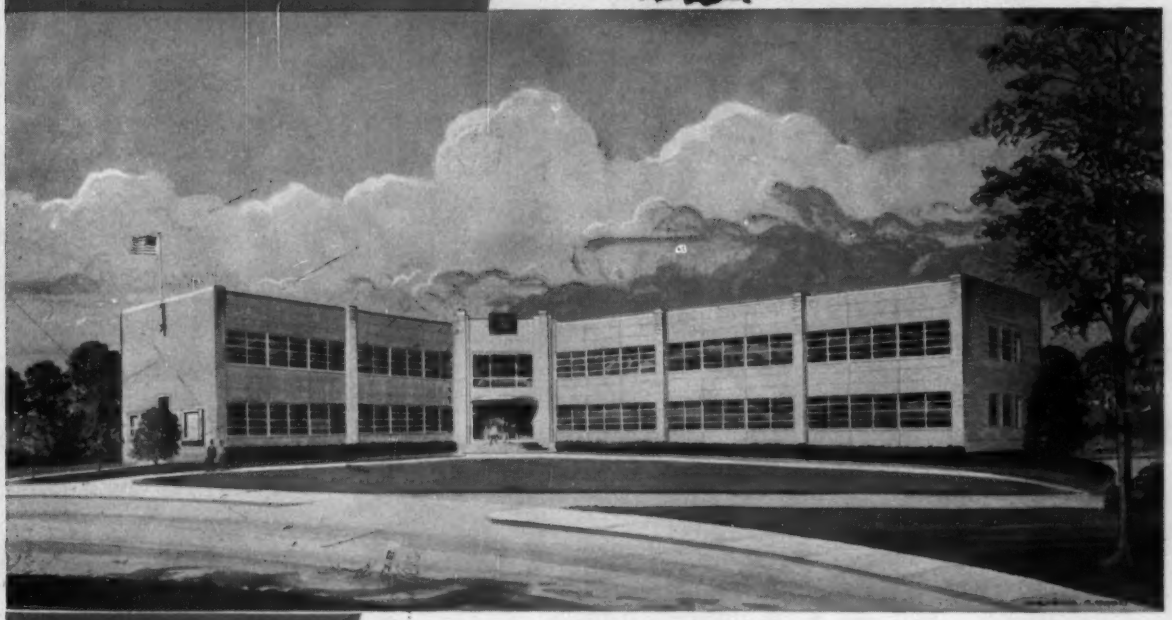
All types of **GOLD SEAL TAPE** — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls. Every roll cellophane-protected, stays fresh. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

DIAMOND SEAL
Friction and Rubber Tapes are also made by Jenkins Bros. to ASTM specifications

TRADE JENKINS MARK SINCE 1864 Jenkins Bros

THE HOME

REMEMBER *Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.*



THAT TREES BUILT

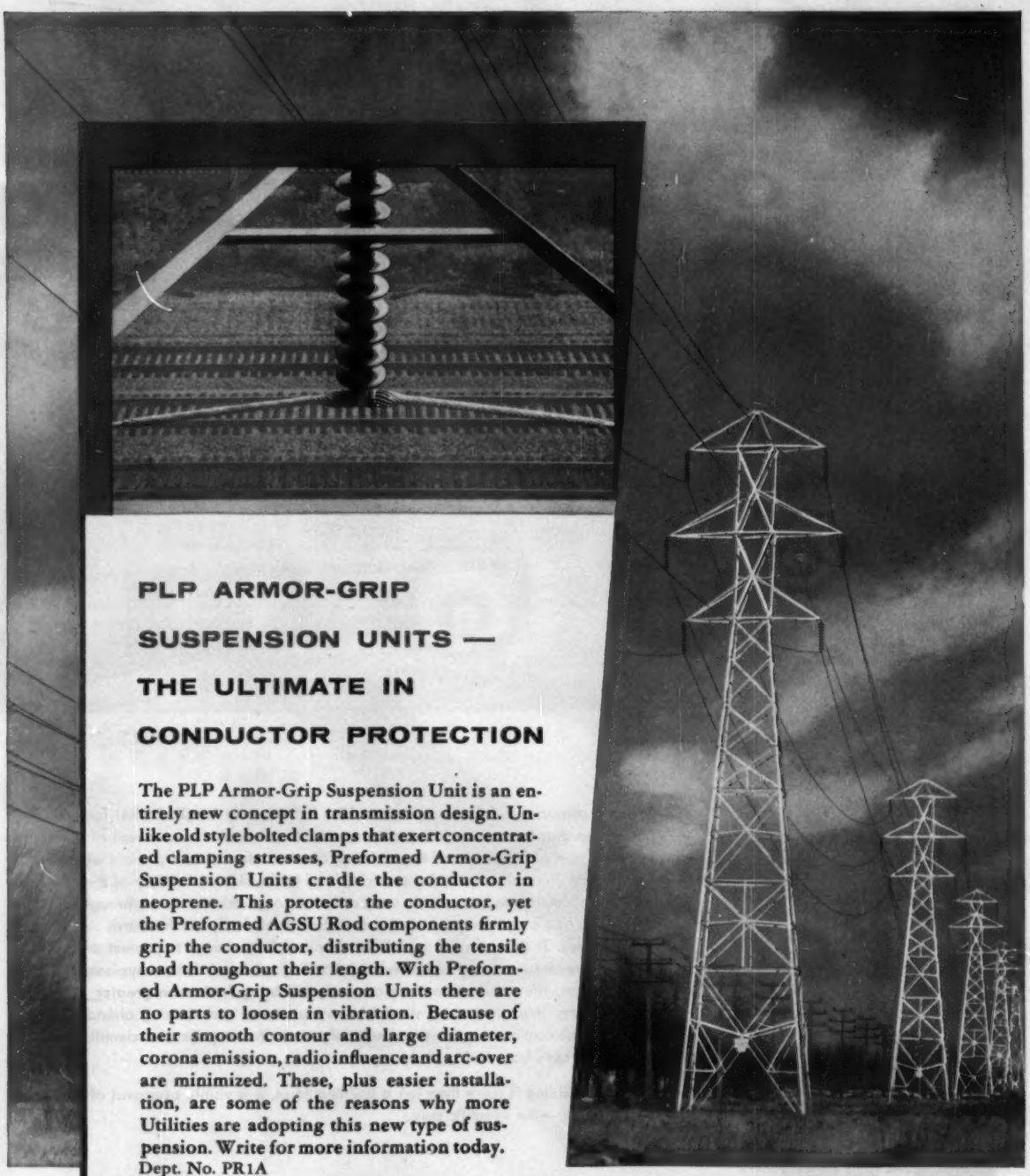
When a company builds a new home office it frequently is asked what factors have been most prominent in its achievements. In our case we owe much of our steady progress to the enthusiasm of thousands of clients both past and present whose loyalty and friendship we value so highly and to the skill and ability of the men and women who have made up the Bartlett organization down through the years. We also take pride in the contribution made by our Research Laboratories. Their continued search for new and better ways to protect shade trees has resulted in many of today's outstanding advances in tree hygiene and preservation. The years ahead, we are sure, will bring forth even greater achievements. We are looking ahead, planning ahead and working ahead so that we shall continue to give those who rely on us the very best in scientific shade tree care both today and tomorrow.

Our new building is more than just a building to us. It is visible approval of the Bartlett Way—the scientific way.

1907-1957 50 years Progress in Scientific Tree Care

BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana.
See your Local Telephone Directory for Local Address.



PLP ARMOR-GRIP SUSPENSION UNITS — THE ULTIMATE IN CONDUCTOR PROTECTION

The PLP Armor-Grip Suspension Unit is an entirely new concept in transmission design. Unlike old style bolted clamps that exert concentrated clamping stresses, Preformed Armor-Grip Suspension Units cradle the conductor in neoprene. This protects the conductor, yet the Preformed AGSU Rod components firmly grip the conductor, distributing the tensile load throughout their length. With Preformed Armor-Grip Suspension Units there are no parts to loosen in vibration. Because of their smooth contour and large diameter, corona emission, radio influence and arc-over are minimized. These, plus easier installation, are some of the reasons why more Utilities are adopting this new type of suspension. Write for more information today. Dept. No. PR1A

PX-79

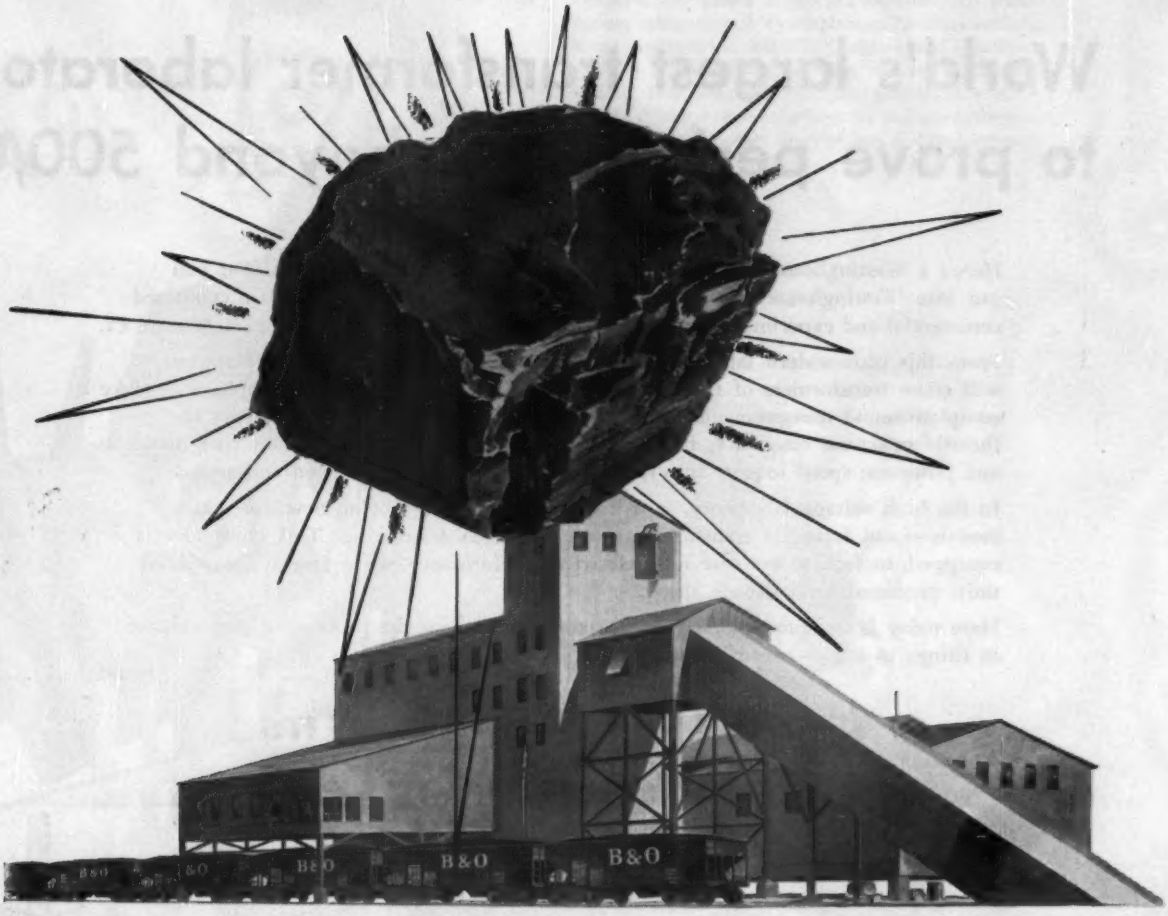
PLP Armor-Grip Suspension Units support these 132 KV Cleveland Electric Illuminating Company lines.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Telephone: Cleveland EXpress 1-3571

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.



Energy Unlimited!

BILLIONS OF TONS OF LATENT POWER... READY TO MEET THE FUTURE'S NEEDS

➔ Bituminous coal offers the nation a priceless commodity —a virtually untapped source of low-cost power. The B&O serves areas with proved *usable* reserves containing billions of tons of this *fuel with a future*, convenient to industry's heaviest concentration.

As population grows and living standards soar, the added energy requirements can easily be met by B&O Bituminous. In addition, its modern mining and utilization will assure greatest efficiency at stable, low cost. *Ask our man!*

LET OUR COAL TRAFFIC REPRESENTATIVE HELP YOU!
He will gladly suggest the perfect constant-low-cost Bituminous coal for your particular needs.
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NEWEST WESTINGHOUSE TEST CENTER . . .

World's largest transformer laboratory to prove performance beyond 500,00

Here's a Westinghouse investment that is now adding value to every dollar you put into Westinghouse power transformers. In one vast new facility is a combined commercial and experimental testing laboratory at the Transformer Division, Sharon, Pa.

From this ultramodern laboratory, used primarily for research and development, will come transformers of the future. The new anechoic vault, for example, will make complete sound measurements to and beyond 500,000-kva ratings; find ways to throttle structural resonance; ferret out strengths and weaknesses of new core materials and processes; speed inquiry into new methods of reducing vibration and sound.

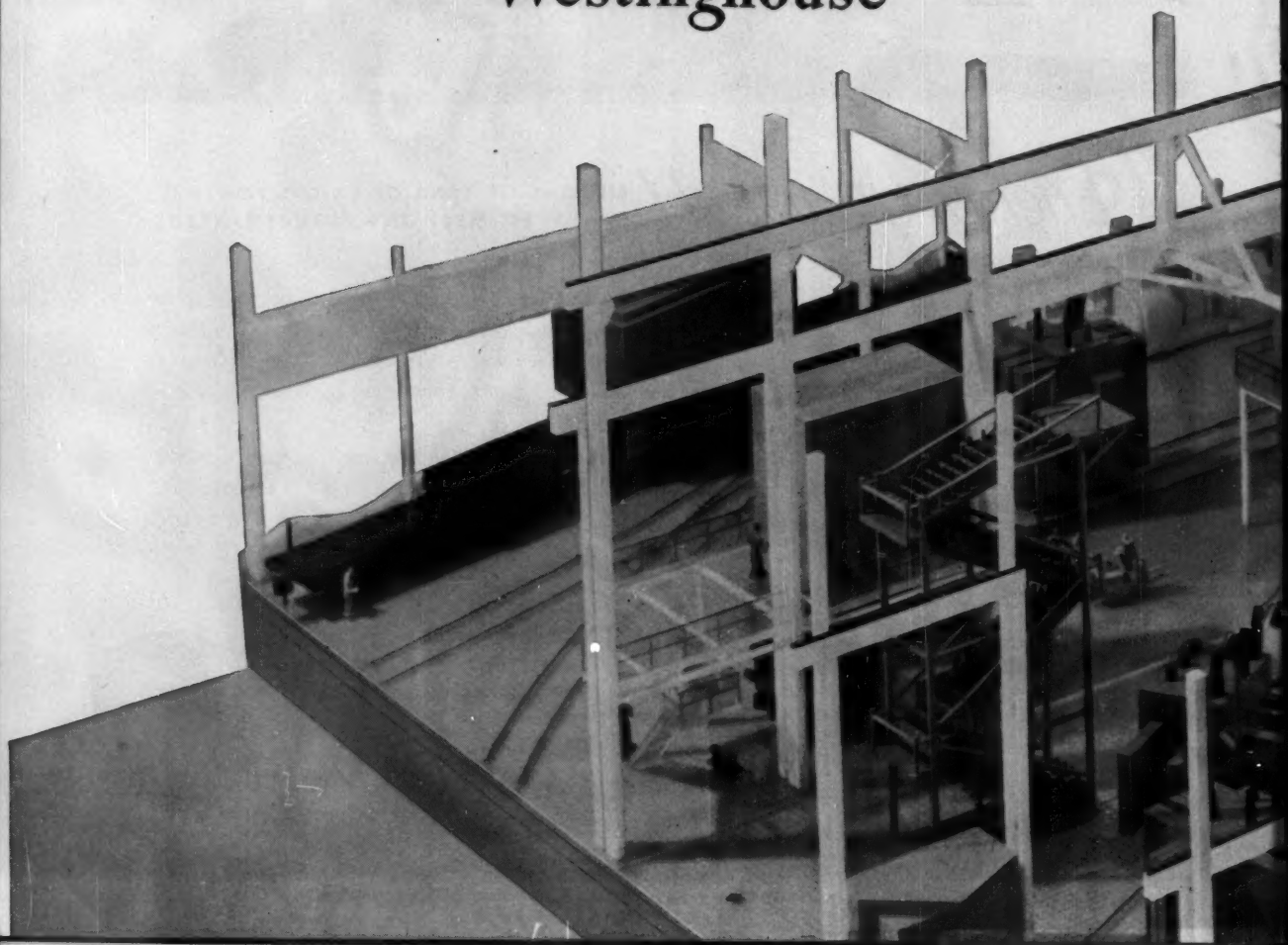
In the high-voltage laboratory, new insulation systems are being developed. Here, models — and full-scale transformers — are tested to destruction. This laboratory is equipped, in fact, to evaluate total electrical performance of the largest commercial units predicted for a decade ahead.

Here today is equipment that immeasurably strengthens the promise of performance in things to come — from Westinghouse.

J-70783

YOU CAN BE SURE... IF IT'S

Westinghouse



M. E. Fagan, Engineering Manager, Transformer Division, and model of world's most modern transformer laboratory at Westinghouse. Facilities include surge generators at 600,000, 4 million and 5 million volts; a 1,050,000-volt, 60-cycle test set for insulation; a 180,000-ampere impulse generator; a completely shielded sound chamber for radio interference testing of small power transformers and components.

KEEP A KIDDE EXTINGUISHER NEAR EVERY HAZARD!

Move fast against fire the instant it strikes, and you can stop it with little damage. But let it get a head start, and you may lose your equipment, your buildings . . . or your life.

Be selective in your choice of fire extinguishing equipment. Choose Kidde! You can be certain of rugged construction, simple operation, and absolute dependability.

For more than thirty years, Kidde fire extinguishers have been built to the most exacting specifications, have passed the most rigorous of tests, have the highest ratings. There is not a better-made extinguisher on the market today.

In ease of operation Kidde extinguishers also stand unsurpassed. The trigger-release grip on Kidde carbon dioxide and dry chemical extinguishers is the fastest and most natural to use. With it, even inexperienced operators can move swiftly and confidently against a blaze, extinguishing flames in seconds. You simply aim the horn, pull the trigger, and fire's out. Models with squeeze valves available too.

Finally, there is the Kidde service organization. In cities everywhere there are trained Kidde representatives who are ready to service your extinguishers.

For more information about the complete line of Kidde extinguishers, write for Kidde's P-8 Catalog.

Walter Kidde & Company, Inc. 130 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

Kidde

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc. and its associated companies.

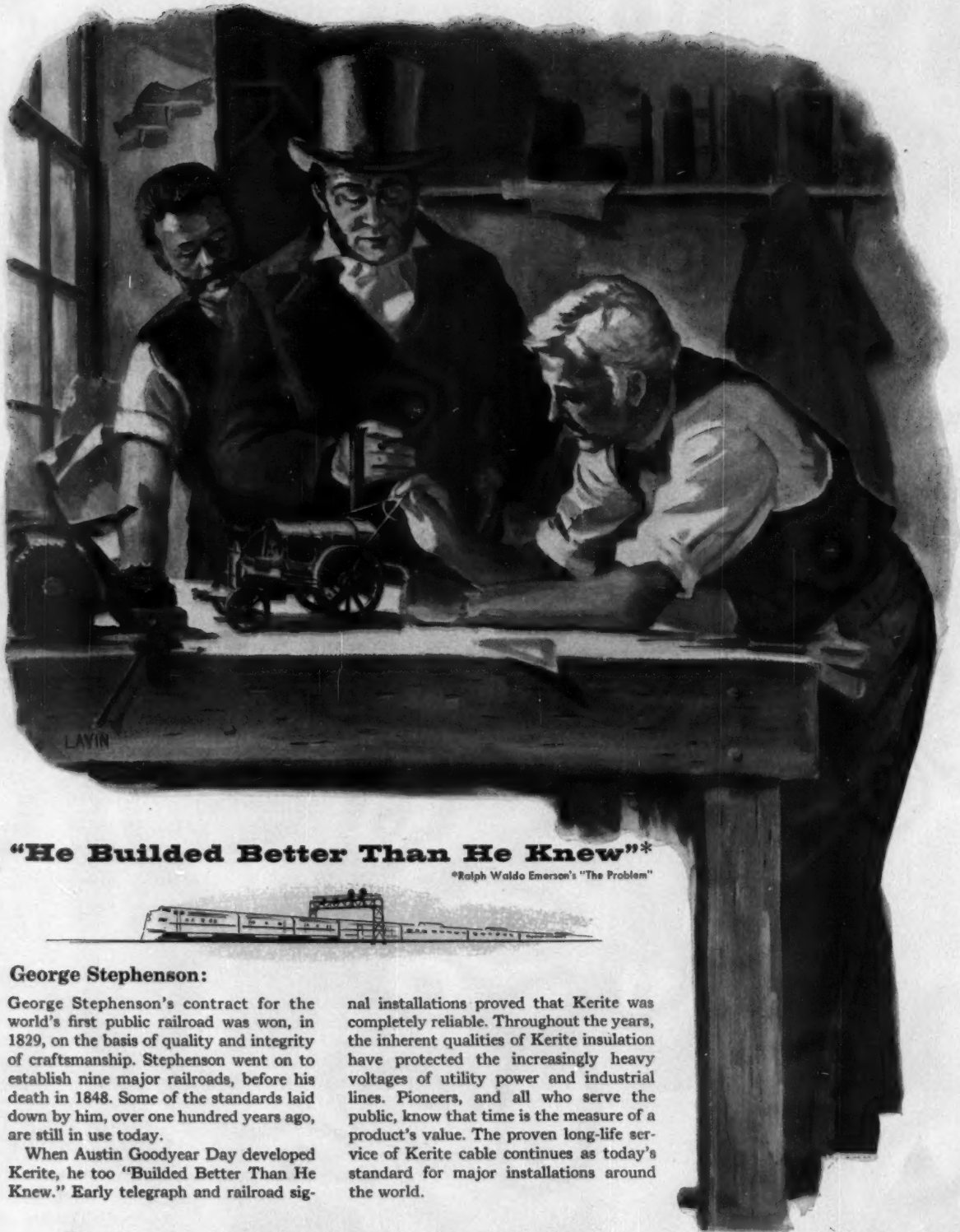
LCU-10 SERIES

ANDERSON ELECTRIC

Performance at Point-of-Contact is what counts! Anderson Electric's new U-bolt aluminum parallel groove connector with COVER ALL spacer . . . maintains cable configuration . . . speeds installation . . . provides more area contact . . . increases range . . . increases pull-out strength . . . assures inhibitor protection.

ANDERSON ELECTRIC CORPORATION
P.O. Drawer 2151, Birmingham 1, Ala.

minum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATIONS • TRANSMISSION • DISTRIBUTION



"He Builded Better Than He Knew"*

*Ralph Waldo Emerson's "The Problem"

George Stephenson:

George Stephenson's contract for the world's first public railroad was won, in 1829, on the basis of quality and integrity of craftsmanship. Stephenson went on to establish nine major railroads, before his death in 1848. Some of the standards laid down by him, over one hundred years ago, are still in use today.

When Austin Goodyear Day developed Kerite, he too "Builded Better Than He Knew." Early telegraph and railroad signal installations proved that Kerite was completely reliable. Throughout the years, the inherent qualities of Kerite insulation have protected the increasingly heavy voltages of utility power and industrial lines. Pioneers, and all who serve the public, know that time is the measure of a product's value. The proven long-life service of Kerite cable continues as today's standard for major installations around the world.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston;
4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio;
29 West Lancaster Avenue, Ardmore, Pa.

Founded 1854

A Basis for Action in Power Education

"The teaching of electric power in colleges has steadily and dangerously deteriorated since the war. Today the power option has disappeared in most schools and has become much the weaker branch in others."

With these words Dean L. V. Bewley of Lehigh University recently (EW, Jan. 7, p 54) put his finger on a situation that is quite capable of retarding the pace of future progress in the power industry.

In his analysis Dr Bewley traces the situation to three basic causes:

- The apparently greater opportunities in the field of electronics
- Attrition and exodus of outstanding teachers of power to industry, and
- Tardiness of the electrical industry in awakening to the situation.

What marks Bewley's observations with distinction is the manner in which he carries his analysis beyond the customary recitation of educational and industrial short-comings. He proposes a constructive six-point program to revitalize the teaching of electric power. His program calls for:

1. Designation, by a properly authorized college-industry committee, of those schools especially qualified in the way of staff, equipment, curricula, and interest to teach electric power.

2. Endowment by electric utilities and industry of one or more outstanding professorships in electric power in each of these designated schools.

3. Provision by industry through loan or gift of the necessary laboratory equipment including modern machinery, instruments, network analyzers, computers, and high voltage testing equipment.

4. Inauguration of a campaign to interest students in the study of power.

5. Provision of a number of scholarships and fellowships in the power field to assist and attract outstanding men.

6. Arrangement for summer employment of instructors and students in the power field.

Although most of these things are being done now in one place or another, Dr Bewley's six point program integrates them into a single constructive plan for revitalizing power education. While it is quite possible that all may not completely agree with Lehigh's dean, there is less to be feared from that direction than from further footless argument and recrimination that has marked past consideration of the engineer shortage and its causes.

Dean Bewley has offered a basis for improving the education and usefulness of engineers needed by the electrical industry. The program appears sound and worth considering. It is to be hoped that it can become the basis for positive action for this is the essence of today's need in engineering education. Further delay on this is quite capable of retarding the pace of progress in the power industry.

Ask the Ladies. They'll Tell You

A recent survey, "Ask the Ladies," by Consolidated Edison Co of New York will be of interest to every power supplier in the United States. The ladies didn't hesitate to speak out. They want to live better . . . electrically.

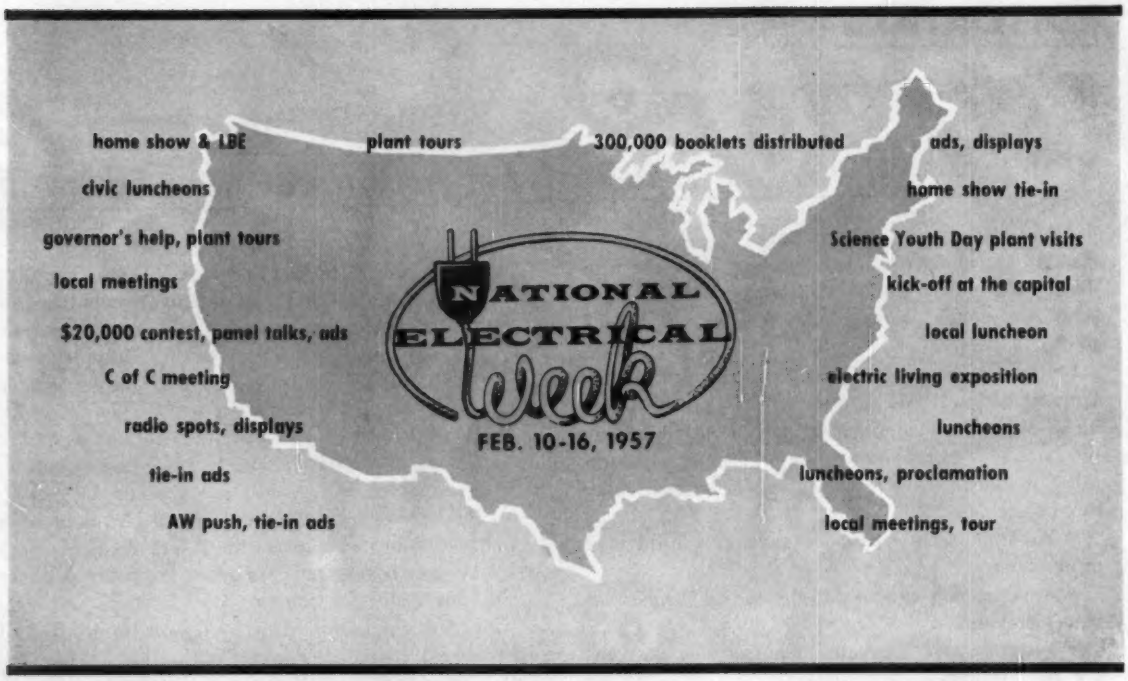
The survey covered 1,531 apartment housewives (70% of New Yorkers live in apartments) and covered kitchen and laundry needs. Here is what they said they wanted in their homes:

- Larger kitchens with more counter space.
- More storage space for electric appliances.
- Better kitchen lighting, especially under cabinets and over the sink and range.
- More kitchen appliance outlets.
- Larger refrigerators (9 instead of 7-cu ft).
- More of the kitchen appliances now on the market including an electric dishwasher.
- Their own automatic washer, preferably with a dryer combination.

Consolidated Edison is a combination company; so about 99% of the women have gas ranges, but about a third favored the electric range. And while about 95% have electric refrigerators, only six women prefer a gas refrigerator.

The New York survey gave the company a good picture of what the women in its area want in their kitchens. If other power suppliers make this survey in their own territories, they may be surprised to find out what their women customers want in their own homes.

nity's economy. PG&E dealers be heard on the night of Feb. 11. World, and Retailing Daily; mate-



National Electrical Week Preview:

Utilities and Allies Will Hit It Hard

- **Observance gathers local and national strength as it enters its second year. Nationally, it will be plugged by TV, radio, magazine, newspaper ads**

- **Local exhibits are expected to attract public—especially in Cincinnati with its "Home in the Clouds"**

"An outstanding cumulative impact . . ." This is the goal for the second observance of National Electrical Week Feb. 10-16.

Merrill Skinner, national NEW committee chairman, bases this view on "the tremendous backdrop being provided by network television, radio, and publication advertising, and reports we have on state and local activities . . ."

In small towns from Buffalo, Minn. and Newburgh, N. Y. to Walnut Creek, Calif. and Palestine, Tex., and in every major U. S. city, Skinner reports local committees have set up extensive plans. Here are some highlights:

Washington, D. C.—Skinner, vice president and director of Union Electric Co, St. Louis, will open the week in the nation's capital at an electrical trade conference and Exposition Feb. 12. The three-day meeting will display residential, commercial, and industrial equipment for 7,000 visitors.

Philadelphia—NEW coincides with an annual Home Show, which will draw up to ½-million people. Philadelphia Electric Co exhibits include a light-conditioned living room; 100-A Housepower; garden lighting; "Heart-Saver Kitchen," developed in cooperation with the regional Heart Association; and a skeleton house wiring display. A show feature is a four-trailer Live Better . . . Electrically Caravan.

Cincinnati—More than 100,000 people are expected at the Electric Living Exposition Feb. 9-17, sponsored by Cincinnati Electrical Association. One feature, a "Home in the Clouds" contest, will find three married couples taking turns living in an all-electric, glass-walled, glass-floored home suspended from the exhibit hall's ceiling.

Detroit—Some 300,000 high school students in and around the city will get Electricity in Your Home quiz booklets. The city's league plans a full-scale program of civic luncheons.

Phoenix—The governor will address an opening day dinner. Besides a state-wide educational program, open houses at new Arizona Public Service Co and Salt River Power District facilities will stress NEW.

San Francisco—Drawings for $20,000 worth of appliances will boost dealers' store traffic. Pacific Gas & Electric Co and Northern California Electrical Bureau are sponsors. City's Electric Club members will hear a panel discussion on industry's role in commu-

nity's economy. PG&E, dealers, and manufacturers plan ad campaigns.

Seattle—A Home Show sponsored by Home Builders Association is scheduled in conjunction with NEW. Electrical industry exhibitors will also feature LBE theme.

In these and other cities luncheons, speeches, and proclamations will be buttressed by newspaper sections, TV-radio programs and spots, dealer sales campaigns, and distributor contests. Emphasis will be on industry contributions to progress and economy, plus a boost for improved wiring and living better electrically. Electrical leagues are spearheading the activities.

Canadians will join the bandwagon too. M. J. McHenry, Canadian Electrical Council president, says, "the national rallying point" is a Toronto industry meeting Feb. 13, "with a speaker of cabinet rank."

Manufacturers have lined up an impressive array of NEW messages. Here's a partial schedule reported by the national committee:

Allis-Chalmers—Feb. 9 and 16, Farm and Home Hour radio spots will include a two-minute talk by Skinner during the first show. The Father of Modern Electric Living, a one-hour salute to Edison, will be heard on the night of Feb. 11. A-C has sent out ½-million copies of two comic books on Housepower. Reprints of a two-page, four-color Saturday Evening Post ad and other promotional material have been delivered for distribution. On local fronts radio and newspaper ads will carry NEW news. Employee magazines will feature the story also. James Murphy, assistant ad manager, says their program will reach a cumulative audience of about nine million.

General Electric—The GE Theatre (Feb. 10) and Cheyenne (Feb. 12) TV programs are having NEW announcements. Local TV and radio coverage in Erie, Pa. and Schenectady, N. Y. will follow suit. In Cleveland more than 6,000 science students will take NEW tours of Nela Park Lighting Institute. Marketing and ad managers in 103 product departments will highlight message in different media.

Westinghouse—Studio One TV show (Feb. 11), quiz show appearances by Betty Furness, and a Wide, Wide World look at the new Pittsburgh research lab are on NEW schedule. An atomic reactor film is set for TV showing in 32 plant and sales headquarter cities. All Westinghouse radio-TV programs in eight large market areas will tie in. Ads in Time, Electrical World, and Retailing Daily; material for distributors and dealers; and Studio One announcement mailings are among additional activities planned.

Advertising and related NEW support will come from companies like Anaconda Wire & Cable, A. B. Chance, Cavalier, Crouse-Hinds, BullDog Electric, Emerson Electric, Metalcraft Products, Triangle Conduit & Cable, Waring Products, and Wiremold.

Leaders of national, year-round promotions have geared big artillery for the week.

A closed-circuit LBE telecast Jan. 30, featured up-coming NEW events and tie-in potential for about 35,000 allies in some 70 cities. LBE and NEW supplements are in the hands of more than 10,000 newspapers. Both topics are being stressed in full-page color ads in February issues of Fortune and Readers' Digest.

Three Housepower groups launch campaigns during the week: **1.** Edison Electric Institute will run ads in Better Homes & Gardens and Saturday Evening Post; **2.** National Adequate Wiring Bureau in Home Modernizing, House Beautiful Building Manual, House & Garden Book of Building, New Homes Guide, and Look; **3.** National Electrical Contractors Association in Newsweek, New York Times, and U. S. News & World Report.

Edison Fete to Stress Science-Youth Theme

Commemoration of the birthday of Thomas Alva Edison will take on new significance this year with inauguration of the National Edison Birthday Celebration and National Science Youth Day, to be held Feb. 11.

The tribute to Edison on the 110th anniversary of his birthday, is aimed at capturing the interest of young people in careers in modern science and technology.

Purposes of the three-fold program are to encourage more young people to pursue careers in science and engineering; to stimulate interest in science education and new developments in fields of science and technology; and to focus national attention on the critical shortage of technical manpower.

To achieve those goals, the Thomas Alva Edison Foundation has sought the cooperation of electric power companies, industry, and professional and educational groups. These groups are to work directly with youth on the local level and to assist in a national public information program.

On the local, direct-contact level, support has been pledged by numerous industrial concerns, whose scientists will meet with students and conduct them on laboratory tours. Atomic Energy Commission is expected to invite high school students to its non-weapons labs and plan special programs for Feb. 11.

National efforts include requests to President Eisenhower and to state governors to emphasize the opportunities in scientific careers and the need for more and better science education. The theme will also be sounded in articles in national publications and programs on network television and radio.

In addition, a 33-page booklet entitled "Edison Experiments You Can Do" has been published by National Edison Birthday Committee with a foreword to the young people of America by Charles F. Kettering, president of the Edison foundation.

GANGED UP for Niagara fight are New Yorkers Javits; Ives; E. J. Machold; Miller; Moses; H. E. Machold; N. Y. Power Authority General Manager W. S. Chapin; and Power Authority's General Counsel Thomas Moore, Jr.

Niagara Battle Begins; Preference Disputed

Republicans, united under new compromise measure, oppose inclusion of preference clause backed by Democrats; both groups favor N. Y. Power Authority development

The long fight in Congress over development of the Niagara power site is under way again. Divergent Republican groups are now united behind a modified public power bill; Senate Democrats already have introduced their bill, identical to the Lehman bill which passed the Senate last session.

The Republican decision kills off any chance for legislation providing for development of the power by five New York private utilities. Both Republican and Democratic bills provide for New York State Power Authority to build the site and market the power, at no cost to the federal government. The main difference between the bills—and the point which provides the conflict—is the Democratic bill's federal preference clause.

Agreement on the Republican bill was hammered out in the office of Sen Irving S. Ives (R-N.Y.) at a meeting attended by Robert Moses, NYPA chairman; Earle J. Machold, president of Niagara Mohawk Power Corp; H. E. Machold, board chairman, Niagara-Mohawk; Sen Jacob Javits (R-N.Y.); and Rep W. E. Miller (R-N.Y.)

The Ives-Javits bill will direct Federal Power Commission to issue a license to NYPA to develop about 2-million kw, of which 445,000 kw will be assigned to Niagara Mohawk. The firm is now licensed to develop this amount from its existing license. In return, Niagara-Mohawk will agree to give up the riparian and water rights of its present license. This license expires in 1971, but the new allocation would be for the life of the 40-year bonds that will finance the project.

Rockslide Alters Utility's Plans

Miller, who will introduce the new GOP bill in the House, led the fight for private development in the past. But he and Niagara-Mohawk joined the NYPA approach as a result of the loss of generating capacity caused by the slide that crippled the Schoellkopf plant.

The $600-million project would be financed by a bond issue by NYPA. Moses said NYPA already has borrowed $375,000 for preliminary work and would need to borrow between $50 and $60-million to get the project going before bonds are floated.

The Republican move is expected to woo some conservative Democrats, particularly Southerners who usually back private power interests. But it is questionable whether they will win over any Democratic public power supporters and whether they will be able to upset the public power majority recorded in the Senate, 48-39, last session in passing the Lehman bill. In the House, the GOP bill likely would attract more votes than the Democratic bill.

Moses says despite the push behind the legislation, he will not drop his court fight for a review of FPC's dismissal of the NYPA application for a license.

Public power advocates like Rep Robert Jones (D-Ala.) say the Republican action doesn't change the picture. Jones charged that without the federal preference clause the bill is no better than the private bill, in his judgment.

AEC Rejects Union Objections to PRDC Project

Testimony of PRDC witnesses on safety and financial status of proposed reactor to remain on record despite protests of three unions, who now plan appeal to AEC

Atomic Energy Commission Hearing Examiner Jay A. Kyle last week threw out most of the 60 objections of three labor unions to testimony of Power Reactor Development Co witnesses concerning the safety of a proposed nuclear project.

This action came with resumption of hearings, after a ten-day recess, into the safety of the project and into PRDC's financial ability to undertake it. The hearings originally had been called at the request of the United Auto Workers, International Paperworkers, and Electrical Workers unions.

Next Move Up to Unions

Kyle's action leaves on the record virtually all of PRDC's testimony on safety and financial status. It is now up to the unions to try to destroy this record by cross-examination of the six PRDC witnesses, or to produce witnesses of their own to counter the testimony.

If, as has been reported, the unions come up with no technical expert to advise them, their lawyers may have trouble upsetting the views of such scientists as Dr Hans Bethe of Cornell University and Dr Norman Hilberry, deputy director of Argonne National Laboratory.

Objections Overruled

Kyle overruled all union objections to the testimony of W. Kenneth Davis, director of AEC's Reactor Division; Alfred Amorosi, technical director of Atomic Power Development Associates, a PRDC subsidiary; and Dr Hilberry—and made only minor deletions in the testimony Dr Bethe; and Ernest R. Acker, PRDC v-p; and Walter N. McCarthy, Jr, of APDA.

In the majority of cases Kyle based his action on the fact that the witnesses were experts and their competency to testify could be tested under cross examination.

The unions are still fighting. They immediately appealed to Kyle for reconsideration of their objections, and when he overruled them, they said they would take their appeal to the AEC.

Union Attorney Harold P. Green told Kyle the unions were still trying to obtain a ruling for AEC on their request for access to restricted data. Inability to gain access to certain documents, said Green, "has severely restricted us in our conduct of this case."

Although Kyle granted the extension of time before reconvening the hearing for cross examination, he warned the unions that the filing of motions with AEC (as they have done for the restricted data) would not be permitted to delay hearings.

AP&L, Reynolds Cry "Foul" . . .

. . . as they fight proposed 58% SPA rate increase; Interior's action called "illegal and discriminatory"

Efforts of Interior Secretary Fred A. Seaton to increase rates charged Reynolds Metals Co and Arkansas Power & Light Co under an aluminum power contract are being fought by the two companies.

Both firms have asked Federal Power Commission to reject Interior's application for the proposed 58.7% increase. The rate hike would apply to power purchased by the companies from Southwestern Power Administration under a three-way, 30-year pact negotiated in 1952 by Oscar Chapman, then Secretary of Interior.

AP&L buys the power and in turn supplies it to Reynolds' aluminum reduction plant at Arkadelphia, Ark. But under the contract, AP&L has to absorb half the first rate hikes up to 15% and one-third of any increases over the first 15%.

Seaton contends the existing provisions fail in two important respects: they discriminate against public bodies and co-ops, and are insufficient to recover power costs.

The current rate is about 5.2 mills. Interior wants this boosted to 8.25 mills, at a cost of about $1-million-a-year.

The case concerns the validity of a contract negotiated in good faith with the government. But it is also directly involved in the whole SPA power rate situation.

Interior is seeking an overall rate hike for SPA power, sold mainly to public bodies and co-ops, to reduce the $2-million-a-year loss from SPA's operations. When the increase was proposed about a year ago, nothing was said about raising rates charged AP&L and Reynolds. Subsequent public power outcry apparently has forced Seaton to attempt a pact change.

Reynolds says Interior's request is a "repudiation" of a contract which was an essential national defense project. The contract's rate provisions were what induced the firm to spend $30-million building the aluminum plant, Reynolds adds.

AP&L says Interior's action is illegal, inequitable, and unduly discriminatory. It contends that the contract rates have returned to SPA as much as $280,000 a year more than the full cost of service. AP&L also argues that FPC has no jurisdiction to act in this instance; that FPC action would be passing on rights of parties under contract.

What AP&L and Reynolds find particularly galling is that they agreed, when the contract was signed, to future graduated rate increases within specified limits. It was only then that Reynolds consented to build its plant.

Atomic Insurance Coming

• Three groups of insurance companies propose to underwrite nuclear reactor plants on an individual basis, providing liability and property damage coverage

Nuclear Energy Liability Insurance Association, a syndicate of 135 stock insurance companies, is preparing to offer up to $50 million of liability insurance coverage for individual commercial atomic reactors.

This was reported at a meeting of the Atomic Industrial Forum in New York by Charles J. Haugh, vice president of Travelers Indemnity Co.

He said another company—a mutual company—will offer $15 million of liability and property damage insurance, and a third group—a stock company—will make available $50 million in property damage insurance for the nuclear facility itself.

Haugh said premiums would be worked out for each individual case. A basic rate will be established for the first $1 million of insurance coverage. After the first million, he said, the premium per million on the next $4 million would be 50% of the basic rate; the next $5 million of insurance, 20% of the basic rate; the next $10 million of insurance, 10% of the basic rate; the next $20 million of insurance, 5% of the basic rate, and coverage over $40 million, 2.5% of the basic rate.

Haugh said the syndicate probably will set a minimum annual premium of about $1,000 for each $1 million of total coverage on power reactors.

The basic rate will be determined by type of reactor, use of reactor, power level, location, and degree of reactor containment. Haugh said the rate may be too high or too low, because of a lack of operating experience. If after 10 years of experience the rates prove to be too high, some retroactive adjustment probably will be made, he said.

The basic liability insurance rate will be many times higher than rates now quoted for similar insurance on present-day power plants, a New York insurance broker predicted.

Meanwhile, Congressmen have introduced bills aimed at providing federal insurance for commercial atomic plants. The bills have called for indemnification for damages exceeding the $60 million available from stock and mutual insurance companies, up to $500 million.

Reactor Nears Completion

This is the capsule-shaped containment vessel for General Electric's developmental boiling water reactor at the Vallecitos Atomic Laboratory, Pleasanton, Calif. Late this year, the reactor is expected to provide steam for generating this country's first privately financed atomic electric power. Pacific Gas & Electric will install a 5,000-kw turbine generator to take steam from the reactor. The power will be fed into PG&E's distribution system. The reactor will form part of GE's test and research facilities.

NUCLEAR NOTES

"Maximum permissible exposure" for workers in privately operated atom plants is three-tenths of a roentgen per week, according to new safety standards set by AEC. The standard exposure for the public outside the plants is one-tenth of the standard for workers. Effective Feb. 28, the regulation is aimed at minimizing radiation hazards.

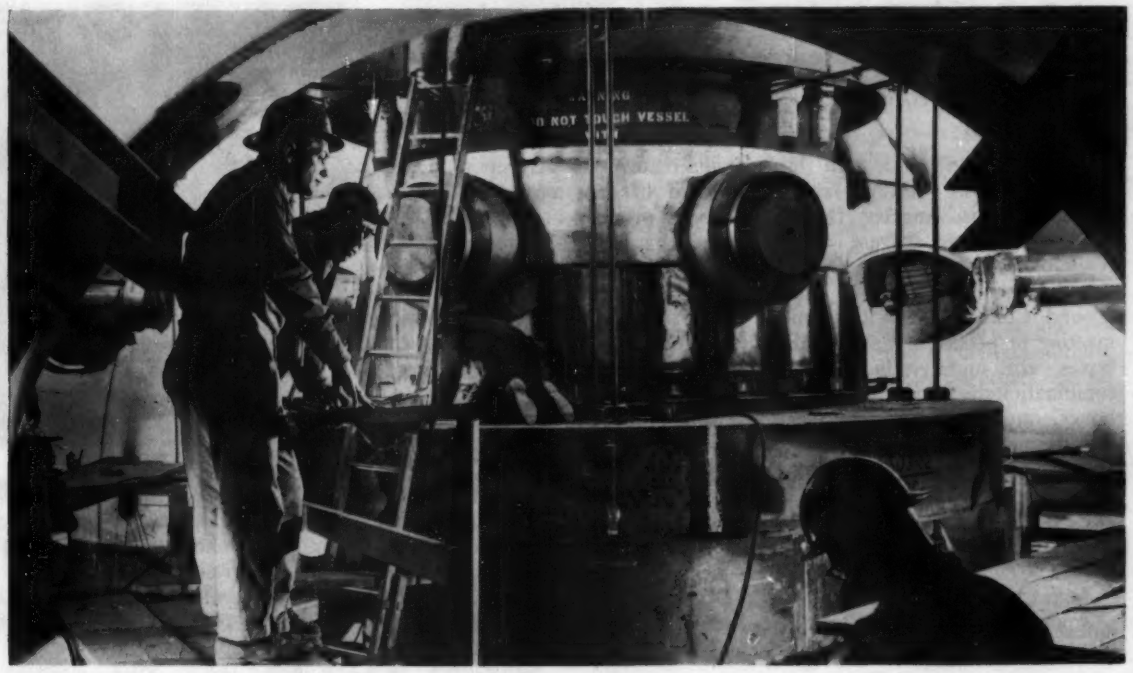
The Joint Committee on Atomic Energy begins public hearings Feb. 19 on the growth, development, and state of the atomic energy industry. The Committee is to receive testimony from representatives of the Atomic Energy Commission, industry, and other interested individuals and organizations.

A one-week nuclear reactor training program is now available at Aerojet-General Nucleonics, San Ramon, Calif., for use by industry, colleges, the medical profession, and electric utilities. In announcing the program, Aerojet said students will be allowed to handle actual nuclear controls and reactor hardware, such as control rods and fuel elements. Students also will be instructed in nuclear reactor theory, assembly, operations, and licensing.

The AEC has asked Congress for a 24% increase in funds for reactor development, including a 60% rise in spending on civilian reactors during the fiscal year beginning July 1. Estimates for fiscal 1958 include $95 million for civilian power reactor development.

Mexico's Federal Commission of Electricity has queried U. S. manufacturers on the price of a 30,000-kw nuclear power plant. But AEC has no bilateral agreement with Mexico, and there is doubt that Mexico could pay the price of such a unit.

A nuclear reactor center has been established in West Caldwell, N. J., by Daystrom Nuclear, a division of Daystrom, Inc. A 36,000-sq-ft laboratory has been completed. It will house an "Argonaut" reactor to train college faculty members.



Shippingport Atom Plant Takes Form

The United States' first commercial nuclear power plant is beginning to take shape, as these pictures show. Situated at Shippingport, Pa., the plant is to be operated for the Atomic Energy Commission by Duquesne Light Co.

Schedule calls for first power generation late this year, or by early 1958. Duquesne will own and operate the electric generating facilities, but the Atomic Energy Commission will own the nuclear plant.

Above photo shows part of the reactor vessel. Hot water will be discharged through the pipe openings at 2,000 psi from the top of the reactor vessel to loops in the wall ports. The reactor vessel is shrouded in a stainless steel jacket and housed in a steel cylinder.

Bottom left photo shows the heat exchanger now in place. This is where steam will be generated at 600 psi by heat extracted from the reactor coolant water.

Bottom right photo shows controls for the reactor and turbine-generator plant. Mimic bus layouts on the control boards will help the operator.

Photos by Robert Yarnall Richie

Tenite Blocks Solve Judson Box Problem

• Los Angeles Dept of Water & Power makes substitution because phenolic type spacers fall down on job at high temperatures and voltages

Failure of phenolic-type insulated spacers in Judson boxes has prompted Los Angeles Dept of Water & Power to use molded tenite blocks instead, J. D. Oliphant reported to the Western Underground Committee at its January meeting in Modesto, Calif. Judson boxes are underground oil-filled combination disconnect and junction boxes, rated 7.5 kv and 500 amp. Use of tenite is based on successful application under high temperature and high voltage conditions.

C. B. Anderson, California Electric Power Co, said his company has been substituting tenite blocks in boxes bought since 1954.

Anderson also said that Calectric plans to incorporate into service requirements the inspection and approval of customer-owned underground primary distribution systems serving trailer parks before service will be supplied. This action follows a recent case in which the contractor building the distribution system for a trailer park resorted to substandard practices to lower costs.

During a roundtable discussion of the availability of utilization voltages in transformer vaults, one company reported it provides 120-v convenience outlets for the use of hand tools. These outlets and the circuit to the vent fan motor are protected by a multi-breaker. A second company uses a "small" wire in the fan circuit to act virtually as a fuse in case of trouble. A third company connects fans to low-voltage bus with no protection.

Woodbury: New Chairman

WUC members elected H. L. Woodbury, Glendale Public Service Dept, chairman for 1957.

For PG&E: Big Power Units

• Company standardizes on 325-Mw generator size as smallest for the future; EHV transmission coming

Probable changes and advancements during the coming decade in engineering design and administrative operations on his system were forecast by J. K. Horton, vice president, Pacific Gas & Electric Co, at the January meeting of the San Francisco Section of AIEE. PG&E is turning to 325-Mw units as the smallest size of generators for the future.

This unit size will provide a 5% better heat rate over 165-Mw units recently installed at Pittsburgh Steam Plant. The next step will be to units about 50% larger than 325 Mw.

Horton looks for nuclear power to become competitive with conventional plants during the 1960's because of the probable availability and higher cost of fuel.

The trend toward more semi-automatic operation of existing and new hydro plants will continue on the PG&E system. Of 70 hydro plants expected to be in operation in 1965, less than 25% will be attended, Horton said.

Extra high transmission voltages (up to 440 kv) are in prospect, too. At least one 220-kv line will be built by the company for conversion to extra high voltage. Use also is planned of bundled conductor on 220-kv lines. The present trend toward larger aluminum conductors for transmission will continue.

Distribution OK until 1970

In distribution, Horton does not expect the need for a higher secondary voltage or primary distribution voltage higher than 12 kv to materialize before 1970.

Automation in PG&E operations will produce significant changes, said Horton. System load allocation of steam and hydro generation will be automatic. It will factor in line losses, machine efficiencies, and stored water.

Performance Tests Slated for EHV Cables, Equipment

Performance tests for extra-high-voltage cables and equipment are being planned by Association of Edison Illuminating Companies and Edison Electric Institute.

To be conducted at Cornell University, the tests will cover 345-kv-class cables, joints, and terminals designed for about 500,000 kva normal summer rating.

Probably four types of cables will be tested at once. Voltages will range as high as 415 kv and temperatures as high as 90C during the first two years. Accelerated aging tests the third year may raise voltages to 450 kv and temperatures to about 115C.

The tests are to begin about April 1, 1959. By that time, the bus structure and equipment will be ready. Westinghouse Electric Co and American Gas & Electric Service Co have pledged the transformers which served in tests at Tidd, Ohio, and cable samples will be provided by several manufacturers in time for installation with their accessories, joints and terminals, by the end of 1958.

Bubbling Ice-Busters

Engineers at Winnipeg (Can.) Hydro-Electric System's Slave Falls Dam are using air bubbles to melt surface ice, reports Graham Corrigan, vice president, Atlas Copco Eastern, Inc, Patterson, N. J.

A compressor pumps air through a 1.5-in. pipe running across the 1,200-ft dam about 14 ft below the surface. Bubbles stream toward the surface at 50-ft intervals along the pipe. They carry warmer water with them from the bottom of the pool. This melts surface ice, Corrigan said.

He pointed out that Sweden already uses the inexpensive technique to keep ice-clogged northern ports and waterways open.

Fences, Towers, & Boys

Oklahoma Gas & Electric hopes it has a "boy proof" enclosure for its new Oklahoma City substation. The utility substituted a concrete block wall for the traditional chain link fence topped by barbed wire.

New York State Supreme Court Justice C. O'Brien has ruled that Rochester Gas & Electric Corp was not at fault in the accidental electrocution of an 18-year-old youth who climbed a 160-ft highline tower at 1 a.m. on July 14, 1954. The verdict followed a jury trial of a $75,000 negligence suit filed by the boy's father.

No Two-Headed Coins, Now

The flip of a coin may determine which clouds will, and which clouds won't, be seeded in "randomized" experiments at the University of California which are designed to reveal "conclusively" the merits of rainmaking efforts.

In earlier experiments, the technique left "too much" to the discretion of the meteorologist, University statisticians believe. To put it bluntly, results could be made to appear excellent by seeding approaching storms that would bring more rain to the target area than to a nearby area selected for comparison. Flipping a coin to determine which clouds to seed should, in time, yield less controversial data, the statisticians say.

Human Mole Fixes Pipe

When a 24-in. circulating water line serving a 7,500-kw turbine sprang a leak under multiple tracks of Northern Pacific Railroad, it posed a problem to engineers of Montana-Dakota Utilities Co. Excavating the damaged section was out of the question, for this would tie up railroad traffic. But a human mole solved this knotty problem:

The Beulah Dakota Station plant crew excavated the pipe along the tracks. A "doorway" was cut into the pipe, enabling a welder to crawl in and make successful repairs. He was provided proper ventilation from the other end of the pipe.

Beware the Watchdog

Attorney General Brownell, in a speech to a New York State Bar Assn meeting, staked out his antitrust watchdogs to guard the civilian atomic energy industry. But Washington observers see no specific antitrust action brewing.

In fact, Brownell pointed out that competitive problems in the infant industry have not as yet been serious. But he cited the tendency of several companies to seek licenses for joint participation in costly atomic projects.

His speech serves notice, however, that the Department of Justice intends to play a policeman's role in atomic energy as it is doing now with its antitrust action against Radio Corporation of America, which acquired some radio and television stations with FCC approval.

Easing the Workload

Cleveland Electric Illuminating Co servicemen, who yearly answer about 95,000 calls from customers who need blown fuses replaced, are now installing improved lag-type fuses in switchboxes. The fuses are designed to reduce outages due to temporary power surges.

"Sugar-Coated Rehash . . ."

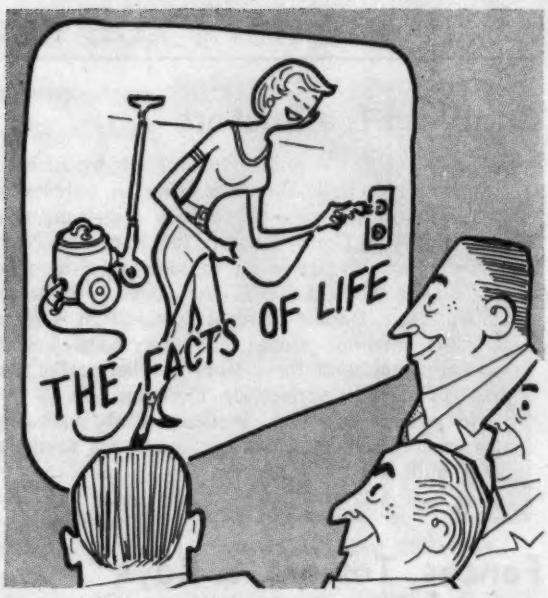
Northwest Public Power Assn's proposal to create a Columbia River Development Corp has been forged into form for submission to Congress. It provides for the planning, financing, and construction of hydro projects, and an expansion of the existing federal transmission system.

The model bill would permit issuance of 50-year revenue bonds and marketing of power to public and private utilities.

However, Kinsey M. Robinson, president of Washington Water Power Co, termed the bill a "rank form of five-man dictatorship—a sugar-coated rehash of the 1949 Columbia Valley Authority bill which seven Western states already have firmly denounced."

He said the bill discriminates against 1,148,964 customers, and gives the five-man board dictatorial powers to confiscate private business and property through "sudden" condemnation proceedings.

1 **BOOKLETS: Facts on employees' competitive situation vs public power gain high readership**



2 **SLIDE SERIES: Story on U.S. profit system fundamentals makes free enterprise more meaningful**

Five Employee-Centered Programs

R. HAROLD ANDERSON, Publications Editor, Washington Water Power Co, Spokane, Wash.

Pacific Northwest public power spokesmen have claimed hundreds of thousands of boosters for the socialization of the electric industry. The number included roughly everyone in the area who was served by or had heard of a public system.

Stevens County—Case in Point

Yet there is much convincing evidence disputing this presumption of endorsement of public power by the general populace. For example there is the result of the election in Stevens County, Wash., where consumers, given a simple choice of business-management or political operation of their electric system, selected business by 71%. Another is on-the-spot observations of columnists and commentators who noted the lack of enthusiasm among the people for the socializers' position in the Hells Canyon debate.

Undoubtedly a large share, perhaps a major portion, of this climate wherein business management of electric utilities is well accepted can be traced to long-standing employee informational programs by Pacific Northwest utilities.

President Kinsey M. Robinson of the Washington Water Power Co is one utility executive who gives unstinting praise to the part employees play in helping their companies survive. In accepting the electric industry's 1956 Coffin Award, Robinson emphasized that "It is the 1,200 employees and a overwhelming majority of the customers served by our company, rather than any one individual, who made this recognition possible."

Top Management a Prime Factor

Executive leadership, such as that displayed by Robinson and other electric utility leaders, is vital to the execution of employee communications planning. There is no friend like top management; it will always count heavily.

But the further element of planning, execution, and action will in the course of company organization rest as a responsibility on other company officers. During the past dozen years, Pacific Northwest utilities developed methods tried in circumstances even more critical than public power backers' irresponsible propaganda.

Employees Prefer PR "Neat"

Lesson No. 1 brought home to Pacific Northwest utilities is that employees prefer to take their company public relations problems "neat." The problems of a business-managed utility fighting for survival against powerfully placed forces carry little kick when presented in conjunction with—or as an afterthought to—a discussion of wiring practices, a sales presentation, or a safety session.

The employee attaches importance to the issue in direct relationship to the importance with which it is represented to him. That's why more utilities are sponsoring unadulterated meetings of managers-supervisors, supervisors-employees, and employees, where the talk can

3 **CAMPAIGN METHODS: Teaser posters, phone calls, and decorations whet curiosity, up interest**

4 **PROMOTE SPEAKERS, FILMS: Employee support helps one company score a talk a day average**

Bolster Private Power Promotion

be frank, open, and straightforward about company problems in business economics and the unequal "yardsticks" of public power.

The dissenting employee is welcomed, for the common meeting is the place where logic and fact win out. There is a decreasing objection to cost of such meetings. Instead there is increasing recognition of the benefits in increased personnel performance on the job and in the community.

One company issued a booklet based on considerable research, titled "The Public Utility Districts of Your State." This booklet gave complete analysis of the employee's competitive situation under public power. It was for employees, who read it and asked for more.

Lesson Learned the Hard Way

Workers have a stake in their business-managed companies, yet it remains a function of the informational program to demonstrate that fact. The hard lesson is learned as in a case wherein a Washington state PUD, upon completion of condemnation of a private company's properties, promised employment to the company force. At the end of one year, not a single employee remained.

Needed: Profit System Story

The easier demonstration of how the employee fares under free enterprise can be performed as a Western utility did it—through a slide series presenting the basic "profit system" story. This is a lesson that even doctors, merchants, and industrialists need to be reminded of occasionally.

Another offering from utilities experienced in employee communications is the unconventional program. No matter how economically meaningful or politically important, it need not be pedantic in presentation. Employee panel discussions, films, question-and-answer games lend interest and thought.

It is asked, why not the "campaign" method to draw attention to an employee information program? Why not enlist competition in the field of public relations?

One utility, now opening its fall program, will post "teaser" posters every week for four weeks, whetting the employee's curiosity as to what the new theme may be. In addition, rhyming reminders will be on every desk once a week. On "announcement day" phones will ring with a pre-cut message telling of the program, and announcement boards and decorative bunting will festoon office lobbies.

"Campaign" Features Friendship

All this will announce the simple theme that employees are being asked to make more friends for themselves and their company. If the technique works for sales promotions and political campaigns, why not for employee programs? You can bet the employees of this company will be aware that something is happening!

To suggest themes for communications programs is an individual problem of the utilities, experienced public relations directors say. Most agree that the starting point is a sound, valid consumer's attitude

5 **GOOD DEED SCORECARD: Keep track of how many friends workers make, how they help 'em**

6 **NEXT: HOUSEWIFE'S HELP? Future may bring coffee hour information via employee's wife**

poll. But even with the results compiled, they find the field so open that it is difficult to select a problem that lends itself to proper concentration of effectiveness.

90% of Americans Lack Facts

The utility never ceases to experience public misunderstanding regarding rates, extensions, new industries, service, power outages and power development. In addition, it's already been demonstrated that some 90% of Americans have little or no knowledge of the preference clause, and a very like number are hard pressed to explain the partnership plan which they may profess to support.

Does the utility have an obligation to explain these bi-laterial problems that affect survival? The stockholder would undoubtedly urge explanation. The public power boys say no. The most useful gauge, it has been found, is to ask of any informational process: How does this help solve our company problem?

More revealing is a survey of methods used to channel the employee's desire to participate in the program. The informational program, if properly conducted, will stimulate his desire for action. Perhaps what is more important, it will guide him to active participation.

While their abilities beyond their own jobs are limited, there are definite fields where many employees may help. The idea these days is to reach groups rapidly.

Here's a utility which emphasizes group contacts with the company story through an organized employee's speakers bureau and a well-stocked free-enterprise film library. The employees, in turn, belong to civic clubs, church groups, PTA's and other groups constantly on the lookout for quality programs.

Speeches, Films Are Means to End

As a result of the urge to participate, the speaker's bureau has been making an average of a talk per day over many months, and 6,000 people a month, in groups of 25 and 30, have been viewing the company films. Speakers, films, literature racks are all excellent activities, but they are not ends in themselves. Employee promotion is needed to increase their usage.

Another utility says: Why overlook the most basic of all fields for employee performance?

This is his meeting people, making himself known, making friends, and transferring that friendly feeling to his company.

Can a company ask for progress and keep a report on simple good deeds performed by an employee? This company does, and quite successfully.

Coffee Klatch: Coming PR Tool?

But why stop with the employee? It's possible that his wife is better known up and down the street than he is. Further, she's been informed, through company letters directed to the house, the employee magazine, her company women's social group, and coffee-time talks with other employees' wives about some major affairs in the company programs.

What would happen if utility employees' wives, block-by-block throughout the country, were to invite their neighbors in for neighborly visits. Perhaps company services would be mentioned, perhaps not—certainly they would come up sometime.

We only ask what would happen. We don't attempt to answer. Thus far we've never heard of any utility embarking on such a course.

But it does illustrate the intriguing possibilities of carrying employee communications through to a point where utility problems can be discussed in a friendly, easy, and informed manner.

Costs Cardinal in Rate Design

Varying outlays for service are basic components in a rate schedule designed to obtain a company profit from different customer classes

H. F. G. MAIN, Rate Engineer, Potomac Electric Power Co, Washington, D. C.

Electric utilities have a variety of rate schedules because the cost of furnishing service varies among customer classes. Although the cost of providing service is only one of many factors in the design of the rate structure, it is nevertheless an important one. It is important not only from the standpoint of the relative position of each customer class in the structure but also from the necessity of insuring equitable profitability from the customers within the class. Cost is a guide-post in the proper design of a rate.

Revenues Linked to Rate

Much has been heard about cost allocation or apportionment. Whatever the term used, it is not the cost of furnishing service. It is an allocation or apportionment of the revenues, investment, and the expenses of the business to the several classes served to arrive at the return earned by each class.

On the other hand, a cost estimate is used to determine what revenue must be secured to produce the desired rate of return for each customer class after paying for its share of expenses.

It is clear, then, that for both purposes, an allocation between classes of investment and most items of expenses must be the first step in the process of objective rate design. This discussion will be confined to some of the practical aspects of the problem.

Load Characteristics Vary

The customer classifications to which costs are to be allocated will depend somewhat upon circumstances. Basically, the distribution should be made to classes having significantly different load characteristics which indicate differences in cost. Residential, commercial, industrial, street lighting, etc, are typical examples. Such differences in cost as between urban and suburban customers may be provided for in the design of the rate.

Three major factors influence the cost of furnishing electric service. The energy, or commodity component, which depends upon the kwhr consumed; the demand or fixed cost component, depending upon the facilities held available to meet maximum requirements, although not all in continuous use; and the customer component, the costs incident to servicing the customers irrespective of their power requirements or energy consumed.

The data for analysis of each classification usually consist of the number of customers and the kwhr sold. The kw of demand of the entire system is also known. The maximum demand of each classification, non-coincident with each other, is not usually available but must be determined by test data or some other means.

Actual Tests Preferred

It its, of course, always desirable to know as much as possible about the load characteristics of each class peak demand, daily load curve, peak responsibility, and the like. A usable cost allocation, however, can be made if the non-coincident peak demand is known. This is an important factor in the costing process and should be determined as accurately as possible, preferably by actual testing.

Items Are Critical

The major problem is to distribute properly the known book amount for the cost elements. Electric plant, construction work in progress, materials and supplies, cash working capital, contributions and deposits, and depreciation reserve are typical rate base compohents upon which the return depends. Expense items are usually operating expenses, depreciation, and income and other taxes.

No one basis can be used to allocate the whole of a particular item. The Uniform System of Accounts, prescribed by the Federal Power Commission, is not a functional accounting system and does not provide for such treatment. For example, Electric Plant Account No. 355 includes the cost of all overhead conductors and devices; yet part of this plant may be used solely for service to contract or wholesale customers.

Assembled Functionally

Therefore, it is usually necessary to reassemble the amounts in each of the expense items into functional divisions so that each may be allocated to the customer classifications on a specific basis. For certain items the number of kwhr may be used; for others the kw demand would be fair; in other instances, the number of customers would be proper. It is often possible, by analysis of subsidiary records, directly to assign certain divisions or subdivisions.

The kwhr, at the appropriate loss level, usually is considered adequate as a basis for allocating items of energy or commodity cost, although it must be remembered that not all kwhr cost the same. Base load and nighttime generation are usually cheaper.

Weighting Factors Help

The number of customers normally will serve to allocate items belonging to the customer component. But it may be necessary in some instances to introduce weighting factors. For example, the billing cost of a demand meter customer may be twice that of a block meter customer.

It is in the allocation of the demand or fixed-charge component that the real problem lies. Demand at any time, not just at the time of the system peak, is a controlling factor in apportionment of jointly used facilities. For example, if the system peak occurs in the evening, the industrial plants may be shut

Table I—Methods may be judged by the effect of their application to a hypothetical situation

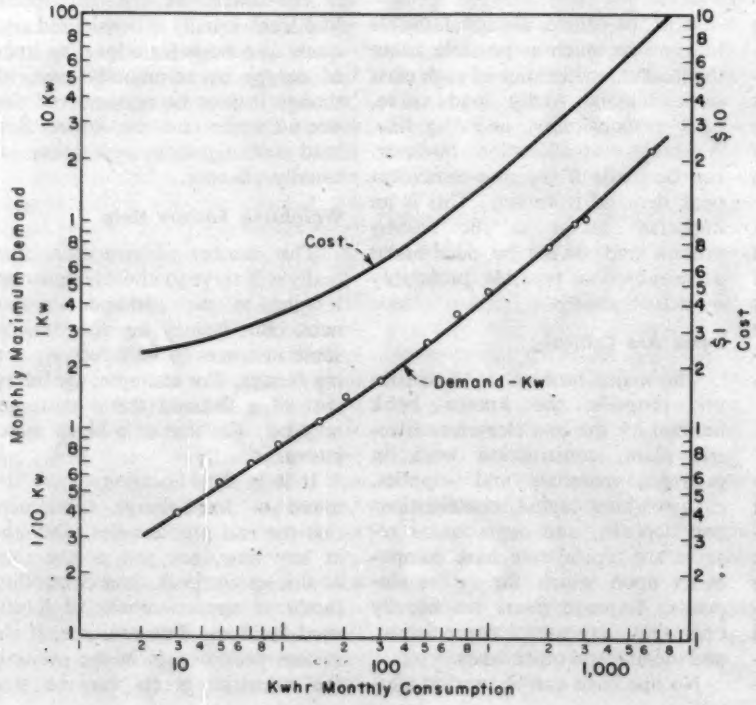
Type of Load	Kw Load Peak	Kw Load Maximum	Annual Kwhr	System Load at time of Class Maximum
Load A—lighting	9,200	45,000	45,000,000	72,500
Load B—Thermal	45,000	45,000	45,000,000	100,000
Load C—Power	33,300	33,300	90,000,000	100,000
Load D—Off-peak	.....	30,000	109,500,000	42,500
Load E—100% LF	12,500	12,500	109,500,000	100,000
	100,000	165,800	399,000,000	

	Allocation of Demand Costs—%						
Method Author	Consumption	Responsibility	Max. Demand	Trustee Law Punga	Weighted Peak Reed	Unused Hills	Capacity Greene
Load A—Lighting	11.3	9.2	27.1	20.4	25.3	8.4	23.2
Load B—Thermal	11.3	45.0	27.1	33.8	32.5	37.6	23.2
Load C—Industrial	22.6	33.3	20.2	25.1	24.0	29.0	20.7
Load D—Off-peak	27.4	....	18.1	11.3	9.2	12.5	20.4
Load E—100% LF	27.4	12.5	7.5	9.4	9.0	12.5	12.5
	100.0	100.0	100.0	100.0	100.0	100.0	100.0

down. Yet they are in use during the day and must bear a share of the demand cost. Thus the peak-responsibility method may not be the solution.

In short, there is no universally satisfactory basis for allocating the costs incident to jointly used facilities. Several methods have been devised, each designed to alleviate or eliminate some undesirable characteristic inherent in others or to inject some desired feature. The analyst must decide for himself which method will be best suited to his particular problem and perhaps devise modifications to accomplish a more equitable allocation of costs.

Fig 1—Demand-Consumption Relationship



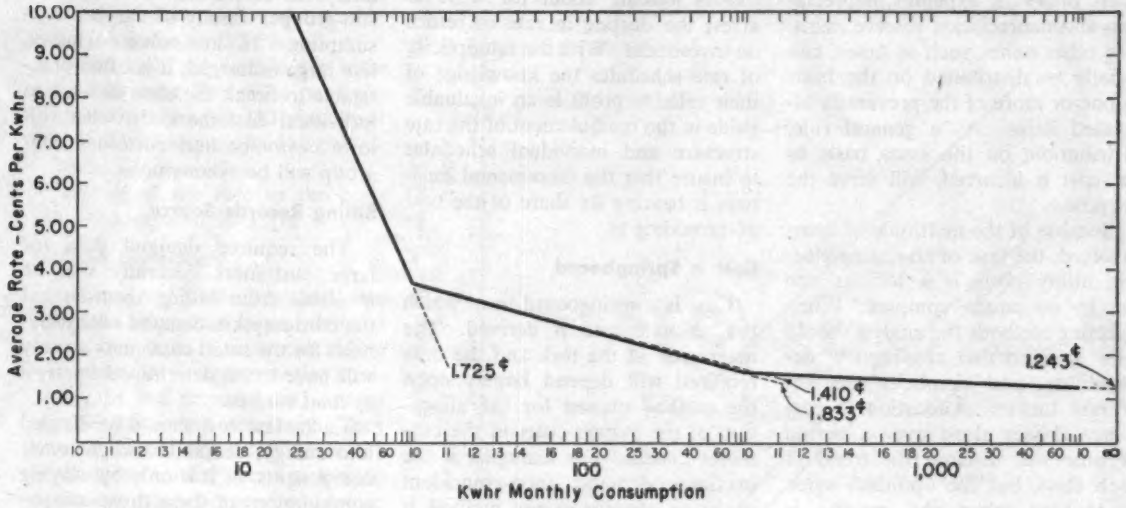
The peak-responsibility method, proposed by Wright[1], shares the costs between the customer groups in proportion to their responsibility for the system peak load. This method is satisfactory as long as the maximum demand of each group occurs at or near the time of the system peak. 100% load factor classes are charged according to capacity requirements, but no charges are assessed against off-peak classes.

Variants Offered

Variants of the peak-responsibility method have been devised to minimize its defects. One such variant (Strickler[2]) averages the contribution of each class to the system peak of two or more days, for instance, a typical summer day and a typical winter day. Another, Ruckwardt[3], used the average contribution on a typical day in each of the 12 months of the year.

The maximum-demand or noncoincident-peak method was proposed by Knight[4] and Snow[5] as the exclusive measure of demand cost responsibility. It shares the costs in

Fig 2—Total Costs Converted to Kwhr (Hyperbolic Graph)



direct proportion to the maximum demands of the customer groups, irrespective of the time of occurance. Under this method high load factor groups are given the benefit of diversity to which they are not entitled and off-peak customers are unduly burdened.

Another group of authors developed methods using both annual peak responsibility and maximum demands. Reed's[6] weighted-peak method allocates the demand costs in proportion to the weighted peak of each class. The latter is defined as the peak responsibility plus a share of the excess of the maximum demand over the peak-responsibility demand, the share being determined by the ratio of the system load at the time of the class maximum demand to the system peak load. Punga's[7] trustee-law method relates the allocation to the sum of the peak-responsibility demand and the maximum demand of each class.

See Diversity Unshared

Some authors consider that demand alone does not take into account the length of time it is imposed on the plant, and diversity is not shared equitably. For instance, a 100% load factor customer would receive credit for diversity to which he contributed nothing. The first of the methods which inject the time element into the problem was Lauriol's[8] unused-capacity method, which used load-duration curves. Variations of Lauriol's method were developed by Eisenmenger[9] and others. All methods based upon this approach, however, are cumbersome to apply.

Another is the "phantom"-customer method, originally conceived by Greene[10], which is built around the idea that if a "phantom" customer could be found to purchase all of the output of a system operating at 100% load factor that was not purchased by the actual customer groups, demand costs could be allocated on a kwhr basis. Since the "phantom" customer is nonexistent the problem was resolved into one of allocating the amount that the "phantom" customer would have paid to the customer groups after they have been charged with their share.

Method Modified

Hills[11] recommended allocating the "phantom's" share on a peak-responsibility basis. If the excess of non-coincident demand over average (100% load factor demand) is used, the method recommended by Greene, it becomes what is known as the average-excess method and the mechanics of its application are fully treated by Nash in his "Public Utilities Rate Structures," page 252.

Ordinarily the heart of the allo-

Footnote References

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[2] A. Strickler: "Die Selbstkosten fur Abgabe elektrischer Energie," Bulletin SEV, 1928, 19, p. 413.
[3] H. Ruckwardt: "Methoden der Verteilung der festen Kosten," Association of German Electricity Supply Undertakings, 1926.
[4] A. S. Knight: "Peak Responsibility as a Basis for Allocating Fixed Costs," Electrical World, 1926, 87, p. 495.
[5] H. A. Snow: "Showing Benefits of Diversity in Loads," Electrical World, 1926, 87, p. 403.
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[8] P. Lauriol: "Tarification de L'Energie Electrique," L'Eclairage Electrique, 1902, 33, p. 325.
[9] H. E. Eisenmenger: "Die Verteilung der festen Stromkosten unter Abnehmer mit Verschiedenheitsfaktor," ETZ 1927, 48, p. 1450.
[10] W. J. Greene: "Allocating Capacity Costs," Electrical World, 1926, 87, p. 1190.
[11] H. W. Hills: Fixed Charges and their Allocation," NELA Bulletin 1927, 14, p. 346.

cation problem is in the electric plant, operating expenses, depreciation and depreciation reserve items. The other items, such as taxes, can usually be distributed on the basis of one or more of the previously allocated items. As a general rule, distribution, on the same basis as the cost is incurred, will serve the purpose.

Because of the multitude of items involved, the task of allocating electric utility costs is a tedious one but by no means complex. When selecting methods the analyst should bear in mind that consistency, defensibility, and simplicity are important factors. Allocation to customer classes alone over a period of time will disclose the trend in each class, but the optimum value is realized when the process is carried down to sub-groups within the class or to individual large customers.

In these days of rising costs and financing problems the utility executive is looking about for ways to arrest the decline in rate of return on investment. With the multiplicity of rate schedules the knowledge of their relative profit is an invaluable guide in the readjustment of the rate structure and individual schedules to insure that the incremental business is bearing its share of the cost of providing it.

Cost Is Springboard

Cost is a springboard from which the ultimate rate is derived. The magnitude of the task and the data required will depend largely upon the method chosen for the allocation of the system costs to the customer classes. For example, if the maximum-demand (non-coincident peak) or average-excess method is used, the maximum or non-coincident demand and the kwhr consumption will serve the purpose.

In the large-volume classes, such as residential and commercial, the analyst is forced into a division by sub-groups, usually of varying consumption. In low-volume classes, like large industrial, it is often practicable to break the class down into individual customers. In what follows customer and customer subgroup will be synonymous.

Billing Records Source

The required demand data for large customers generally will be available from billing records, but the consumption-demand characteristics for the small customers usually will have to be determined by tests or load studies.

Each class cost should be divided into energy, demand, and customer components, as it is only by varying combinations of these three components that the individual costs are determined. The process of subdividing the class into customers should be consistent with that of dividing the system into classes except that the variables are reduced to three. If the revenue to be produced by the class is different from the cost, the difference may be spread over the three components in proportion to the rate base, as return and income taxes comprise most of the differential and are associated with the rate base.

For block meter schedules the energy, demand, and customer costs must be combined to state the total in terms of cost per kwhr. The relationship between the customers' individual monthly demands and their monthly consumptions, necessary for this purpose, must be determined by test or from data at hand.

Total Costs Produced

Assume, for example, that the demand-consumption relationship takes the form shown in Fig 1; that the energy cost is 0.833¢ per kwhr, the demand cost is $1.25 per kw of monthly demand, and the customer cost is $1.75 per bill.

Using the demands from Fig 1, application of these unit costs produce the total costs shown on the chart. If the total costs are converted to costs per kwhr and plotted on hyperbolic graph paper, Fig 2, it is apparent that breaking points in the cost rates occur near the 100, 200, and 1,000 kwhr points. Using these breaking points and arbitrarily

Table II—The fit of the rate to the costs are compared

Kwhr	Kw	Cost	Revenue at "Cost Rate"
20	0.303	$2.29	$2.29
40	0.476	2.68	2.63
60	0.618	3.02	2.98
80	0.746	3.35	3.33
100	0.874	3.67	3.67
200	1.332	5.08	5.08
400	2.184	7.81	7.74
700	3.382	11.81	11.74
1,000	4.526	15.74	15.74
2,000	8.123	28.57	28.12
4,000	14.810	53.58	53.03
7,000	24.213	90.33	90.32
10,000	33.188	126.53	127.61

Table III—Effect of rate compared with costs for a number of typical bills

Kwhr	Kw		Cost	Revenue at "Cost Rate"
	Monthly	Annual		
3,000	9.872	12.256	$39.00	$39.00
4,000	13.266	16.625	51.69	51.59
6,000	20.120	25.552	77.29	76.90
8,000	27.038	34.663	103.05	102.31
10,000	34.686	43.956	129.01	129.00
15,000	52.270	63.644	190.34	190.72
20,000	68.963	82.686	251.04	250.96
30,000	101.920	119.576	371.23	370.75
50,000	166.720	190.322	608.57	608.57

assuming that the customer cost must be recovered at 20 kwhr, the following "cost rate" appears:

First 20 kwhr @ $2.29
Next 80 kwhr @ 1.725¢ per kwhr
Next 100 kwhr @ 1,410¢ per kwhr
Next 800 kwhr @ 1.332¢ per kwhr
Over 1,000 kwhr @ 1.243¢ per kwhr

The fit of the rate to the costs can be compared in Table I.

Treated Separately

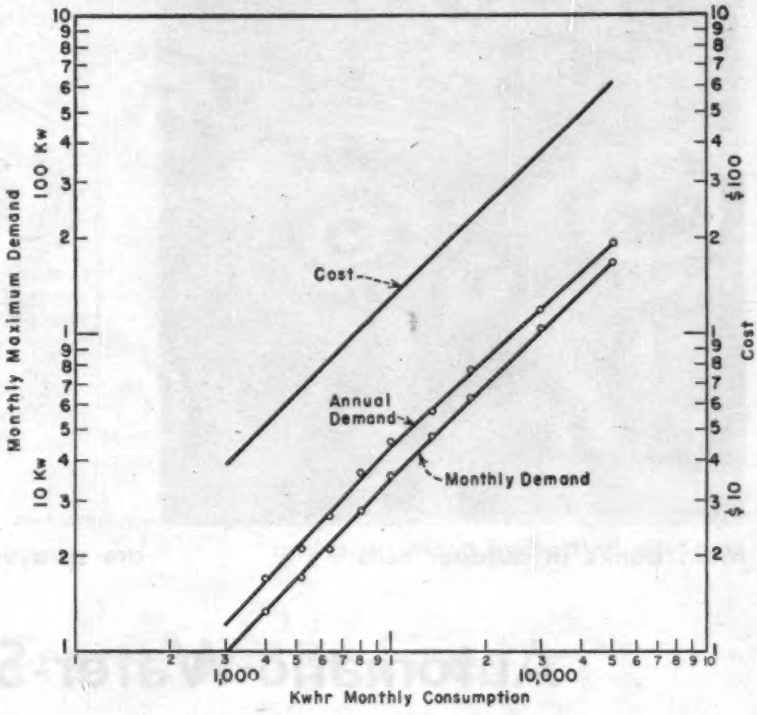
In dealing with two-part rate schedules where the annual demand of the customer is to be the billing demand (100% ratchet), the combining of the demand and energy components is not necessary. They can be treated separately as in the block-meter rate. The distribution of the customer component, a minor item, between the demand and energy charge is almost a matter of judgment. Demand rates based upon annual demand can be made to equal cost for individual customers.

When billing is based upon the customer's monthly demand another problem is presented. Costs are dependent upon the annual demand but monthly demands seldom—if ever,—equal 12 times the annual demand. The relationship between monthly and annual demands of individual customers is determined by the utilization habits of the customer and has nothing in common with the magnitude of the demand or consumption or with load factor. The fitting of rate to cost must be done empirically for each schedule on a total cost basis, which usually will result in costs of one component being collected for in one or all of the other components.

Breaking Point Needed

As in the previous example, assume that the energy cost is 0.8333¢ per kwhr and the customer cost is $1.75 per bill but the demand cost is $1.00 per kw of annual demand. Assume also that the relationships between kwhr consumption and monthly and annual demands for a group of customers take the form of those in Fig 3. Using the annual demands, these unit costs produce the total costs on the same chart. It is evident, by inspection, that a change in the demand trend takes place at about 10,000 kwhr so that a breaking point is necessary at that point.

Fig 3—Monthly and Annual Demand-Consumption



Equating the costs, consumptions and monthly demands for 10,000 and 3,000 kwhr, the required demand and energy charges are $1.737 per kwhr and 0.670¢ per kwhr, respectively. Applying these rates to the total consumption and to the demand for the first 35 kw for a 50,000 kwhr bill, the remaining cost for the kw over 35 amounts to $1.602 per kw.

While it appears that an energy charge rate, which differs from the energy cost rate, would not make a compensatory overall revenue, it must be remembered that the change in the annual to monthly demand ratio constitutes a compensating change in the incremental cost.

Variation Not Serious

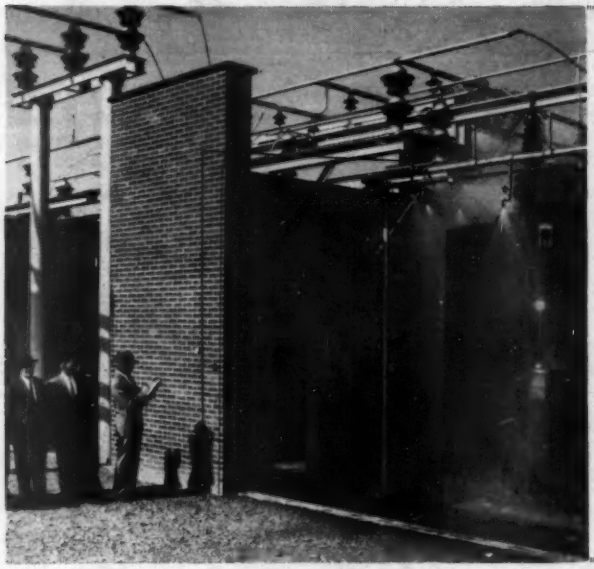
The effect of rate so derived may be compared with the costs for a number of typical bills in Table II.

In this example it would appear from Fig 3 that the variation between monthly and annual demands is not serious. However, appreciable inconsistencies will appear in groups of large commercial and residential customers. The ratio of the sum of the monthly demand to 12 times the annual demand of individual customers can range from 25 to 98%.

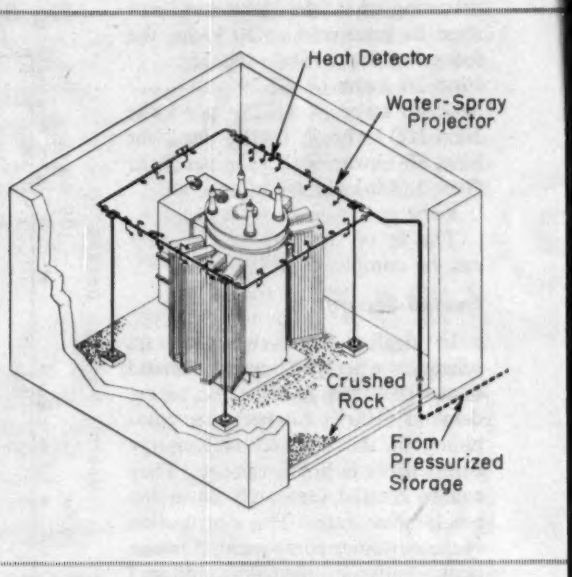
Too much emphasis cannot be placed upon the value of load research in rate design, particularly in the residential and small commercial fields. The spiralling saturations of new appliances and equipment—characteristics of which are not yet too well known—anticipated by Electrical World survey (May 18, 1953) can outmode the most carefully designed rate schedule unless these new loads and their impact are provided for.

Data Handling Speeded

Metering equipment manufacturers have cooperated with utility rate engineers so that there are now in the process of manufacture or development demand meters which record demands on magnetic or punched tapes. Data from these tapes can be translated into punched cards by available equipment so that the cost of processing load study data is materially reduced, thus enabling utilities to benefit from load research which was heretofore prohibitive because of the high costs of processing data.



Main banks in outdoor cells . . .



. . . are sprayed from built-in nozzles . . .

Automatic Water-Spray System

Tank stores 1,000 gal of water to fight fires at unattended substation where the mains are too small to drive the discharge nozzles

RICHARD A. LANE, Senior Engineer, Mechanical Engineering Div., Philadelphia Electric Co, Philadelphia, Pa.

WILLIAM N. LAWTON, Special Representative, Fire Protection Div., Grinnell Co, Inc, Providence, R. I.

Water stored in and discharged from a pressure vessel by high-pressure nitrogen provides fire protection for transformers at Philadelphia Electric Co's Sharon Hill substation. This station requires completely automatic protection as it is unattended. A fire pump taking water from the mains was not practical.

For adequate protection, any proposed substation may be assumed to need at least 750 gpm of water at 50 to 60 psi. At a generating station, where water quantity would seldom be a problem, volume would be 1,000 to 1,500 gpm because of its larger transformers.

Design Checked in Laboratory

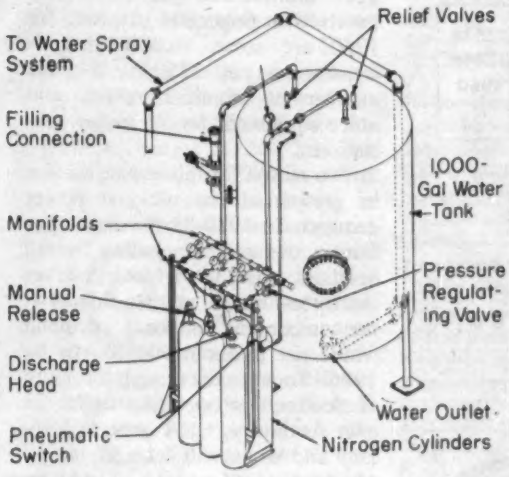
In developing this stored water system, most design work was performed in the Grinnell Co laboratories. It included reduction of a number of interdependent variables. Preliminary determinations of water quantity were made with a 500-gal unfired pressure vessel. Before installation at Sharon Hill, successful tests were made with a 1,000-gal storage tank.

In investigating the gas propellant to be used, consideration was given to carbon dioxide and nitrogen as being inexpensive, readily available, and inert. Dry nitrogen was selected for its freedom from moisture, easy commercial storage at higher pressures, and reduced tendency toward pressure drop at low ambient temperatures. This nitrogen is bottled in regular CO_2 cylinders for use with commercially available, Underwriters' approved, quick release fittings.

Pressure regulating valves were used of a size and type which assured an adequate flow of nitrogen at a fairly constant pressure throughout the period of operation of the water spray system. Trial and error revealed that six nitrogen cylinders and four pressure regulating valves in parallel were required for 1,000 gal of water to assure prompt operation and maintain constant water pressure without overtaxing the regulators. Manifold piping was large enough to minimize pressure drop between the cylinders and the valves.

Water Stored in Pressure Tank

Water is stored in a pressure vessel meeting both the ASME Code U-68 and Pennsylvania Boiler Code for Unfired Pressure Vessels. Two parallel connections were brought to the top of the water vessel from the low-pressure side of the gas manifold, thus equalizing gas velocity for any given unit of flow. Outlet line from water tank to discharge nozzles is continuous and unimpeded by deluge or gate valves or other obstruction which might be closed accidentally to overload the safety valves. The outlet path must be impossible to block under any condition. Two safety valves at separate points on the top of the tank, above water level, can



supplied from water stored inside . . . **and pressurized by bottled nitrogen**

Extinguishes Transformer Fires

pass the full volume of gas discharged from the six nitrogen cylinders.

It was found that water must flow for 10 to 45 sec to completely extinguish a fire, depending upon the fire and weather conditions. To provide an economically feasible installation with a practical factor of safety, 2 min was selected as the maximum discharge time. The test transformer was approximately the same size as that at Sharon Hill so that installation conditions were closely duplicated. Water used was 1,000 gal for each test.

About 1 cu ft of gas is required for each gallon of water. Each nitrogen cylinder contains approximately 175 cu ft at 1,800 psi. In most tests fire on the transformer and adjacent ground was knocked down and extinguished in approximately 15 sec and the last remaining tongues of flame were gone completely in 30 to 60 sec.

Crushed Rock Adds Safety Margin

All tests were without benefit of the crushed-rock fill installed normally on surrounding ground areas. As this would have had a dampening effect on an oil fire, test conditions were considered more severe than those encountered normally in field installations.

After completion of water discharge, an additional 20 to 30 sec was needed to exhaust the nitrogen from the system. This would have a blanketing and inerting effect on the surrounding atmosphere, but no credit was allowed for it in designing the system.

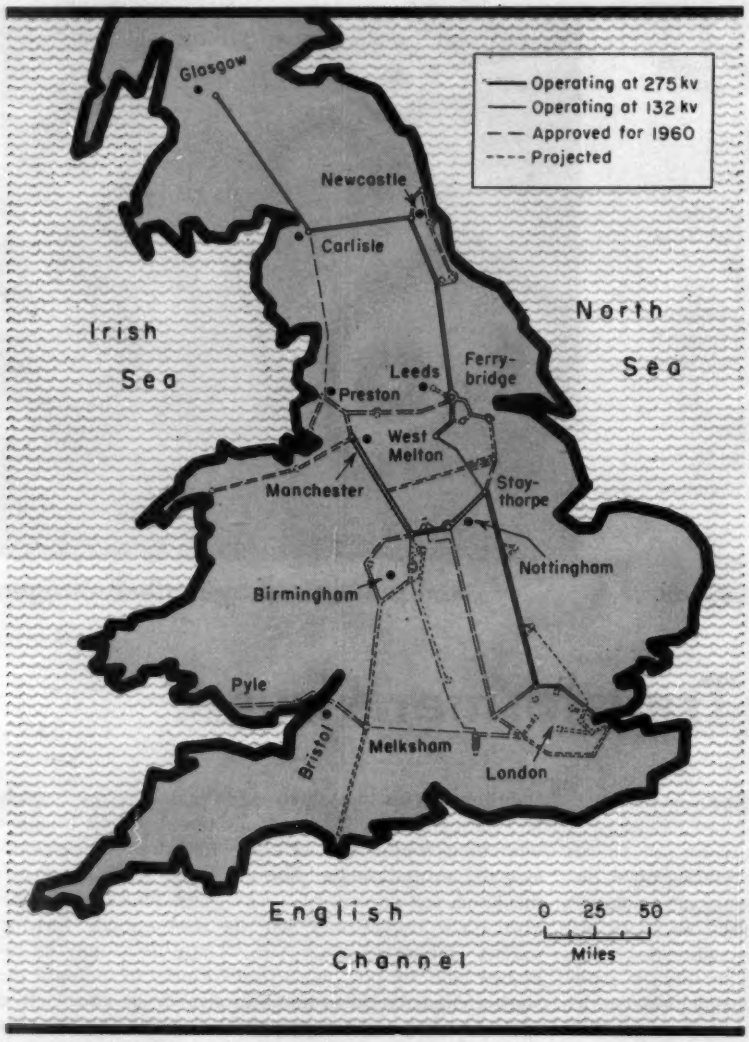
Sharon Hill substation has a small brick structure for low-tension switch-gear and controls. It includes a small room for the three 1,000-gal pressure vessels and another room for three additional vessels together with their piping and valving. In brick cubicles outside the substation building are three 10,000-kva, oil-insulated, self-cooled, 66-13-kv single-phase transformers. Each transformer has its own cubicle for fire barrier and sound absorption. These units may be replaced later by polyphase transformers to increase the station capacity by as much as five or six times. It is anticipated that these polyphase transformers may be protected with the existing type of fire-protection equipment.

Backed Up by Fire Department

Manual cross connections from one unit system to another were considered as a back-up measure but were eliminated because of inherent complexity. Each individual water-storage vessel has a Fire Department connection which would permit pumping water from the street mains with a department pumper.

Automatic equipment in the protection scheme consists of thermostats which operate on an open-circuit principle and open the electric discharge heads on two nitrogen cylinders. The other four cylinders of the tank are operated by a plunger arrangement.

It is recognized that the system will be out of service temporarily following an operation until the water and gas systems are recharged. The station normally will have six fully-charged nitrogen bottles in reserve so that any system can be put back into service within an hour. Exhausted nitrogen bottles can be filled and returned from the recharge station within a day.



Britain Maps Supergrid for 1,500 Miles by '60

Another 1,700 route miles planned for 275-kv operation after 1960; provision made for 380-kv bulk transmission

MORRIE S. HELITZER, Technical Editor, McGraw-Hill World News, London, England.

Britain's 275-kv Supergrid is growing like Topsy. Five years ago a grid of 1,150 route miles was planned to meet the double objective of interconnection and bulk transmission. Today Central Electricity Authority has scheduled more than 1,500 route miles for 1960 operation.

Besides this, CEA is planning an additional 1,700 miles after 1960, with a good-sized network for construction by 1963-64. The original estimated cost of $146 million for the Supergrid has jumped to $218 million and will go higher. Involved in Supergrid planning for 1960 are some 10,000 Mva of transformers at 275 kv, a large number of circuit breakers, and other equipment for 27 major substations.

The reason for this expansion lies in growth of the national power demand. In 1950-51 maximum national demand, including south Scotland, was 13,000 Mw. The Authority estimated at that time that the maximum national demand would rise to about 30,000 Mw by 1975. Today, even though the south of Scotland is operating under its own Authority, CEA expects England and Wales will demand 34,500 Mw by 1965-66 and 70,000 Mw by 1980-81.

The unpredictable factor in the next 20 years is nuclear power. Eighteen months ago, the government estimated that nuclear power plants would have an installed capacity of 1,500 to 2,000 Mw by 1965 and 10,000 to 15,000 Mw by 1975. But at the Calder Hall opening in mid-October, Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, revised those figures sharply upward. He spoke of an installed nuclear capacity of 3,000 to 4,000 Mw by 1965 and 30,000 Mw by 1975—roughly half the country's generated power in 1975.

The Supergrid, operating at 275 kv, 50 cps, is the child of the 132-kv national grid. When that was planned in 1926, nuclear energy was strictly a laboratory idea. The principle of interconnection has been carried forward from that day to this. But it was not foreseen clearly in 1926 that the lines would be vehicles for bulk power transmission.

Although interconnection remains the primary function of the Supergrid, adequate provision has been made for bulk transmission at 380 kv from the coal-rich midlands to fuel-poor London and southeast England. Towers are being built for higher voltages, and extra station and substation space has been set aside for expansion.

The choice of 275 over 132 kv was straightforward:

- 275 kv affords about six times the capacity of 132 kv.
- Lines can operate at lower volt-

ages during transition to 275 kv.

• The higher voltage conforms with international recommendations of 275/300 kv.

The first trial section of overhead transmission lines between Staythorpe and West Melton was intended to operate at 264 kv. But it was switched to 275 kv when the Supergrid was authorized in July 1950. This section, energized in 1953, became the first operational leg of the Supergrid. The only single-circuit section of the Supergrid, it utilizes twin 0.175-sq in. copper equivalent conductors.

These twin conductors, designed for interconnection, have a thermal rating of 375 Mva per circuit. By and large, they are utilized for circuits north of a line between Ferrybridge and Preston.

Circuits south of that line allow for bulk power transmission and use twin 0.4-sq in. copper equivalent with a thermal rating of 570 Mva per circuit. Exceptions are the Ferrybridge-West Melton link and the Melksham-Pyle link—both with 0.175-sq in. conductors. For both type lines the conductors are ACSR, two per phase spaced 12 in. apart.

Towers for the double-circuit Supergrid are like those for the 132-kv grid, except that they employ high-strength steel for main members. Towers for 0.175-sq in. conductors were built originally to a height of 115¼ ft with a basic span of 1,000 ft. Their height has been raised to 121½ ft to accommodate an increased basic span of 1,200 ft. The base remains 22 ft square. The crossarms measure 36½, 38½, and 41 ft with separations of 22 and 22½ ft.

The towers with twin 0.4-sq in. conductors are for operation at 380 kv. They are 136½-ft high and have a base 24½-ft square. Crossarms are 36, 37½, and 40 ft and are spaced at 25½ and 25¾ ft for a basic span of 1,200 ft. CEA has selected a single ground wire for both designs, even at terminal ends. It has 0.175-sq in. copper equivalent cross-section with a 45-deg protection angle.

The system employs banks of 120-Mva, 3-phase transformers with neutral points solidly grounded. Short circuits are controlled by four transformers in groups of two. For higher ratings, cold-rolled steel will enable building a 180-Mva transformer at about the weight of the 120-Mva unit. Weight is a critical factor. Britain limits the combined weight of carrying vehicle and freight to 150 tons.

Circuit breakers are of the bulk-oil and air-blast types. Both have short-circuit ratings of 7,500 Mva; thermal ratings correspond to the overhead line rating of 800 and 1,200 amp. Substation busbars are 3-in.-dia copper-clad steel tube with

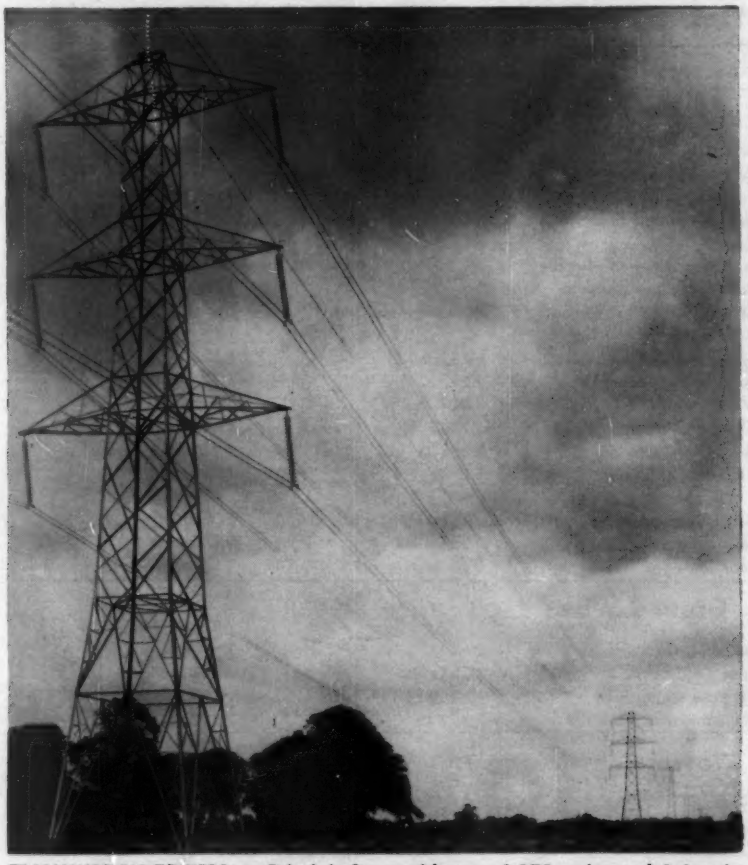
Table I—Vital Statistics of Britain's Supergrid

	275-Kv Lines	380-Kv Lines
Conductors		
Design voltage	275 kv	380 kv[1]
Operating voltage	275 kv	275 kv
Construction	Double circuit	Double circuit
Type of conductor	ACSR	ACSR
Name	Lynx	Zebra
Distances between phases	20, 20, 40 ft	25.5, 25.75, 51.25 ft
Conductors per phase	2	2
Arrangement of conductor on one phase	Horizontal spacing, 12 in.	Horizontal spacing, 12 in.
Conductor dia	0.785 in.	1.126 in.
Ratio of aluminum to steel area	4.29	7.72
Weight per mile	3,009 lb	5,748 lb
Ultimate strength	17,530 lb	29,210 lb
Mechanical tension	2,892 lb	5,489 lb
Aluminum plus steel area per phase	458 sq mm	966 sq mm
Copper equivalent per phase	226 sq mm	516 sq mm
Resistance per mile	0.126 ohm	0.055 ohm
Reactance per mile	0.56 ohm	0.55 ohm
Ground Wires		
No. of wires	1	1
Type	ACSR	ACSR
Ultimate strength	17,530 lb	17,530 lb
Mechanical tension	2,892 lb	2,892 lb
Towers		
Type	Steel lattice	Steel lattice
Average span	1,197 ft	1,197 ft
Crossarm height	74 ft	77.75 ft
Insulation level	1,050 kv	1,460 kv for 380 kv; 1,050 kv for 275 kv
Insulator type, suspension string	cap and pin, glass or porcelain	cap and pin, glass or porcelain
Number, suspension string	18 or 16	18 or 16
Insulator type, strain string	cap and pin, glass or porcelain	cap and pin, glass or porcelain
Number, strain string	16 or 15	16 or 15
Number of strings	2	2

[1]Built with 380-kv clearances but insulated for and operated at 275 kv

Table II—Cost of Britain's Supergrid

	275-Kv Lines		380-Kv Lines	
	$ per mile	% of total	$ per mile	% of total
Tower footings	3,070	6.8	4,600	6.9
Towers, erected	14,740	32.7	23,430	35.3
Insulators	5,180	11.6	6,890	10.3
Conductors	17,170	38.1	30,730	46.0
Miscellaneous	4,870	10.8	1,040	1.5
Total	45,030		66,690	



TRANSMISSION TOWERS on Britain's Supergrid carry 0.175-sq in. and 0.4-sq in. copper bundled conductor, respectively, for 275-kv and 380-kv operation

a rating of 1,200 amp. Normal distance between supports is 27½ ft.

Underground cables are used only to lead into difficult substation configurations. There is talk of using underground cable for the London metropolitan area, but no sizable sections of cable are in the Supergrid.

The chief difficulties encountered in building the Supergrid pertain to rights-of-way. CEA reports that compulsion had to be used for only 15 route miles, a small percentage of the 331 route miles obtained during the year ending March 31, 1956. But there has been some strong continuing residential objection to big towers, even after administrative decisions in CEA's favor.

The other big bottleneck is the short supply of steel. This has delayed construction of towers for as long as a year.

According to Francis J. Lane, CEA's deputy chief engineer in charge of the Supergrid, it is still too early to draw a comprehensive picture of operational difficulties. But the most common problems are damp weather and air pollution, radio-TV interference, and lightning.

In each instance, Lane says, performance to date is encouraging. Weather problems are not as severe as in some countries; RI is not more serious than for 132 kv and is well below American 330 kv; and lightning has not involved both circuits simultaneously.

In its eighth annual report, issued March 1956, CEA listed 5,322 route miles of main transmission system in operation. Of these, 464 belong to the Supergrid, 197 miles operating at 275 kv and the remaining 267 miles of 275-kv design at 132 kv. CEA says an additional 225 miles of 275 kv are scheduled for completion soon.

In early 1956 CEA turned over 84 route miles of 275-kv line to the new South of Scotland Board. This board and CEA (left with 12 area boards in England and Wales) have agreed to run their systems interconnected. Power transfers are to be made on the principle that at all times the over-all fuel cost of generation should be kept at a minimum.

Sometime in the future the CEA-South of Scotland Supergrid will probably tie to a north of Scotland supergrid. But north Scotland has yet to start its first 275-kv line although it is planning one about 80-miles long. North Scotland is now more concerned with tying up its 132-kv lines, providing local distribution, and developing hydro power.

Will Atom Power Outdate Grid?

There are some who argue that nuclear power will make the Supergrid unnecessary. They claim future power stations can be sited in response to demand without regard to coal supplies. Lane contends, however, that the contrary is true. Only by interconnection, he argues, can power be distributed profitably from highly capitalized plant. He believes that for an indeterminate period, starting after 1970, the Supergrid south of the Ferrybridge-Preston line will be pressed into bulk transmission service.

CEA plans an experimental 380-kv line for a 5-year trial, focusing attention on outdoor insulation. Climatic and atmospheric conditions, such as fog and industrial pollution, present a sizable challenge for very-high-voltage operation.

CEA estimates that the Supergrid, with its double-barreled use for interconnection and bulk transmission, eventually will provide annual savings of $14 million. This view is based on the estimated costs of generation, transmission, and extra fuel for a new 132-kv grid which would have been needed had the Supergrid not been undertaken. With fuel and dollar shortages there is an understandable emphasis on economy. But it has a necessary consequence. In correlating the Supergrid with future industrial growth, emphasis is on doing a job with less equipment and less money rather than on using the same money to do a bigger job.

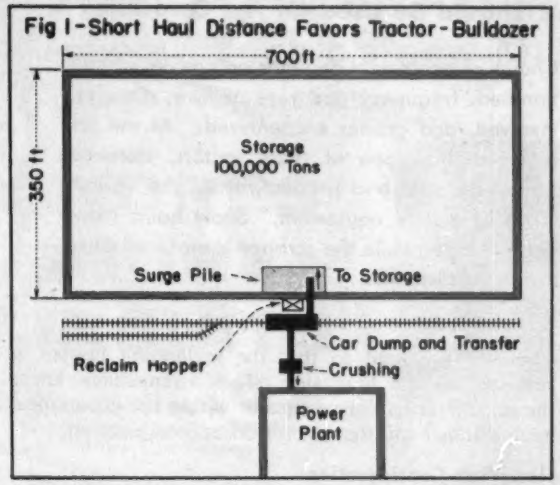


FIG 1—TRACTOR-BULLDOZER is most economical earthmoving equipment for pile shown. Short haul distances favor it

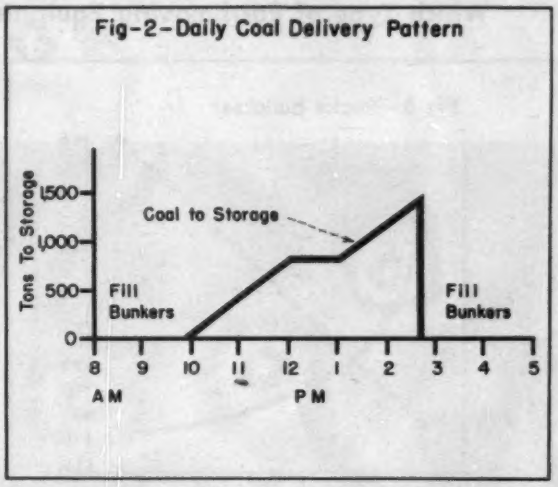


FIG 2—COAL-HANDLING CREW begins morning operation by filling station bunkers. Most work is building storage pile

Many Items Affect Coal Handling

GENERATION
Operation

Quantity of coal handled, and frequency and rate of flow must be considered when selecting coal handling equipment

JOHN RADOMSKY, Sales Development Division, Caterpillar Tractor Co., Peoria, Ill.

Selection of mobile equipment for storage and reclamation of coal depends on many interrelated factors. In addition to quantity to be handled and its frequency and rate of flow, plant designers must consider size of the coal pile, distances of transport, grades encountered, and operating costs. Examining the general capabilities of tractor-bulldozers, crawler-drawn scrapers, and rubber-tired tractor-scraper combinations points up some important facts.

Tractor-bulldozer production falls off rapidly as the haul distance increases. Because of the low speed of this equipment, travel time becomes a large portion of cycle time.

Tractor-Bulldozer Has High Flotation

Nevertheless, the track-type tractor has very desirable features for coal storing. High flotation permits work on loose coal without "digging in." Traction coefficient is high. Stability is excellent, permitting the machine to work close to, or on, the slopes of the pile. The length of the track provides an excellent platform for dozing.

Tractor-drawn scrapers also fall off in production on long hauls where travel time becomes a large portion of cycle time. But this equipment performs better than the bulldozer at haul distances over 400 ft. Owning and operating costs, however, are higher.

The rubber-tire scraper combination depends for effectiveness on use of its basic attribute, speed. When short cycles with a high proportion of fixed time are involved, this unit's higher operating cost becomes uneconomical.

Cost curves show that selection of equipment depends on hauling distances. But as other factors are involved, it is not a simple matter to determine the cost and select the unit for hauls of various distances, once productivity is established for it.

Selection is greatly simplified when the machinery is considered during the design stages of a plant. Lowest over-all unit costs can be developed because the machinery, both fixed and mobile, can be completely integrated.

Requires 100,000 Tons a Day

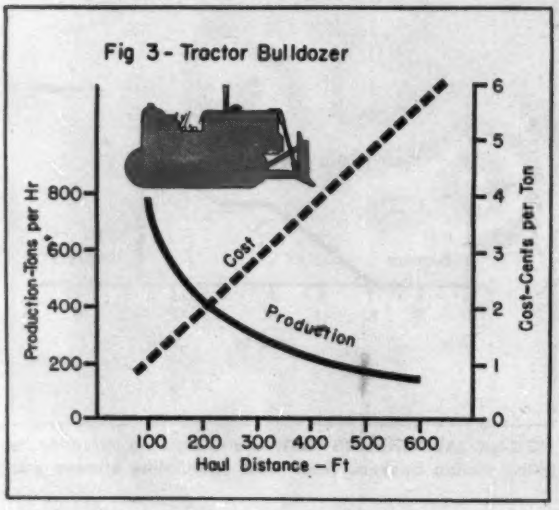
A hypothetical case illustrates equipment selection. Assume that the problem is to choose machinery for a new plant whose initial storage capacity is 100,000 tons. Coal will be delivered by rail. The plant requirement is 1,000 tons per day. Initial delivery rate is 2,400 tons per day (approximately 350 tons per hr for a 6¾ hr actual working day) until storage is built up. At that time delivery will be reduced to 1,400 tons per day. Tractors will operate one 8-hr shift per day.

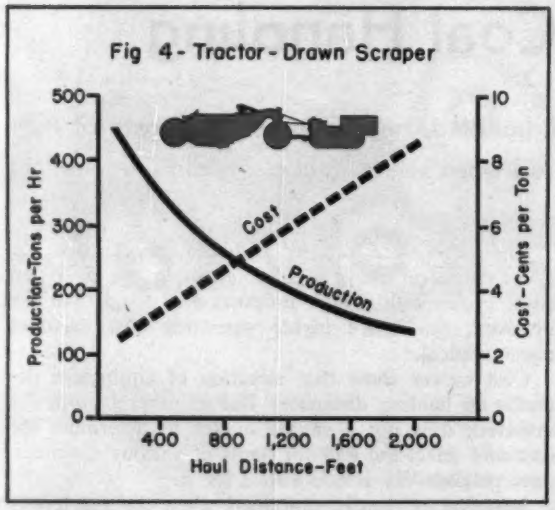
For a storage capacity of 100,000 tons, a pile 30 ft high, 700 ft long by 350 ft wide provides ample space for coal compacted to 70 lb per cu ft.

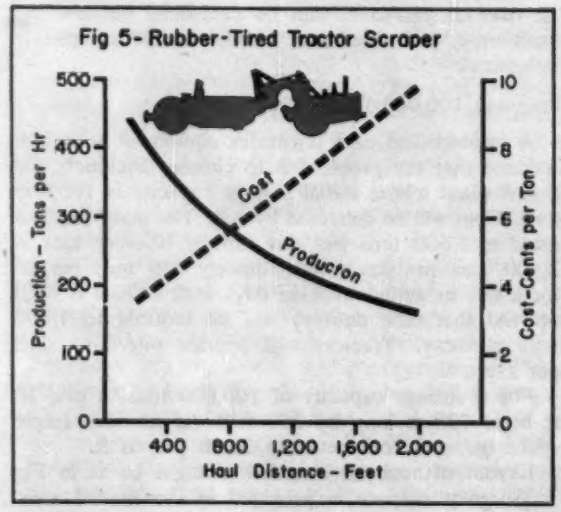
Layout of such an installation might be as in Fig 1. Surge pile space is provided in the shaded area.

Adapted from a paper presented by the author at a meeting of the Canadian Electrical Association.

Which Type of Earthmoving Equipment Should Be Used on the Coal Pile?







Choice of equipment depends on amount of coal handled, frequency and rate of flow, distances involved, and grades encountered. At the left is shown how one of these factors, distance, affects the cost and productivity of the various types of mobile equipment. Short hauls favor the bulldozer while the scraper is more effective at longer distances.

The pile is placed so that the reclaiming hopper is centered on the long side. This arrangement keeps the maximum hauling distances within the economical haul distance of the tractor-dozer combination.

Flow First Consideration

Flow of coal, which the tractor must handle on a daily basis, is the first consideration. As operations start in the morning, all of the coal received is delivered directly to the plant to stock the bunkers. After bunkers are filled, delivery is diverted to storage. The daily pattern of this operation assumes the shape in Fig 2.

Four operations must be studied:

1. Putting coal in permanent storage.
2. Putting coal in surge pile.
3. Supplying coal from the surge pile.
4. Supplying coal from permanent storage during emergency.

All coal in excess of plant requirements is put into permanent storage until the weekly requirement is met. The surge pile is then built up for weekend consumption. The unloading rate is 350 tons per hr (TPH). Maximum average haul distance is 200 ft. This production can be met by applying the tractor-dozer combination, as its capacity is 425 TPH at the required haul distance.

By purchasing machine capacity to meet the need just examined, the plant can supply coal for all other requirements shown here.

Stocking permanent storage . . . 350 TPH at 200 ft.
Reclaiming permanent storage . 154 TPH at 200 ft.
Stocking surge pile . . . . . 350 TPH at 75 ft.
Reclaiming from surge pile . . . . 154 TPH at 75 ft.

The reclaiming rate of 154 TPH is used, as it is the effective rate based on a 6½ hr working period (derated from 8 hr for operator relief, machine maintenance, etc.). The cost per ton for moving the coal is not significantly different, as the operator cost, capital costs, etc., must still be charged. But use of the effective rate (154 TPH) gives a more realistic picture of the cost of operation. Better selection for the day-to-day handling may be made if operating procedures are changed. This is quite important, because, in most installations, the handling of comparatively small tonnages over short distances constitutes a very high proportion of the work.

What is the tractor cost for handling coal in the situations shown above? The hourly owning and operating cost of this machine is $8.80. From the

(Continued on page 105)

Now! At Load Bonus Settings,
General Electric's new ML-32
Voltage Regulator . . .

IGNORES SHORT CIRCUITS

By D. D. MacCarthy, Manager—
Feeder Voltage Regulator Engineering,
General Electric Company.

With the advent of Load Bonus, which G.E. introduced last year, some utilities asked what effect short circuits would have on regulators operating on higher current settings. Now we can give this quick and categorical answer:

General Electric ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated below.

Load Bonus, of course, means that, at ±5% regulation, G-E ML-32 single-phase step voltage regulators are suitable for currents up to 160% of rating, to a maximum of 400 amperes.

Now, the ML-32's extra short-circuit strength allows you to take full economic advantage of the 60% Load Bonus feature in applications where previously short-circuit capacity has been a limitation. Check the chart below. You will note that, in all cases, the ML-32 regulator will withstand short circuits long enough for circuit-interrupting devices to go into action.

For more information on the ML-32, write Section 423-16, General Electric Co., Schenectady 5, N. Y. or contact your General Electric sales office or agent.

Add load, maintain short-circuit capacity:

Regulating Range (Percent)	Load Bonus Current* (% of basic rated current)	Short-circuit Capacity** (% of basic rated current)	Short-circuit Duration (Seconds)
±10	100%	100% x 25	2.0
± 8¾	110%	110% x 25	1.6
± 7½	120%	120% x 25	1.4
± 6¼	135%	135% x 25	1.1
± 5	160%	160% x 25	0.8

*400 amperes maximum
**10,000 amperes maximum

ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated at left.

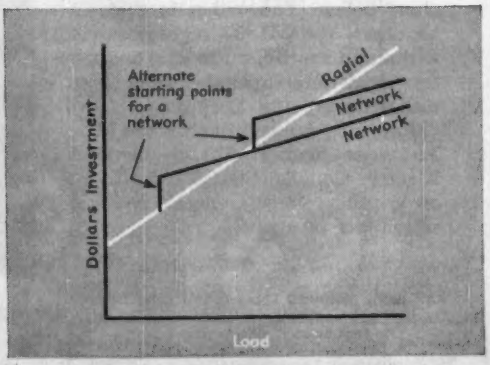
Progress Is Our Most Important Product

GENERAL ELECTRIC

STRAIGHT-LINE INSTALLATION of network transformers in vehicular tunnel proved fast, economical.

How G-E network transformers help Long

IT PAYS TO START A NETWORK



IF YOU INSTALL a network system initially you can economically accommodate load growth in the future.

EASY INSTALLATION. Crew simply moved each 1000-kva General Electric transformer by truck through tunnel to within a few feet of mounting position, skidded each unit into place, and made connections.

WORLD'S LARGEST SHOPPING CENTER, ROOSEVELT FIELD, L. I., N. Y.

TRANSFORMERS UNDERGROUND help maintain modern appearance of shopping center.

Island Lighting Co. solve power problem

L.I. CREW MAKES SPACE-SAVING INSTALLATION OF GENERAL ELECTRIC TRANSFORMERS AT WORLD'S LARGEST SHOPPING CENTER

Construction of the world's largest shopping center at Roosevelt Field, Long Island, posed today's familiar problem—how to best meet an immediate demand for power and also provide for future growth.

Long Island Lighting engineers selected the underground network system because it offers:

1. **Stable Voltage Conditions**—Voltage drop is far less with a network than with a radial system, especially under heavy load demands.

2. **Maximum Dependability**—Units are submersible for underground service—out of harm's way.

3. **Low Cost Expansion in Future**—New loads and new transformers can be added to system without loss of service or the expense of temporary feed arrangements.

4. **Better Appearance**—Use of underground network system is more in keeping with the ultra-modern appearance of the center.

G-E UNITS OFFER EXTRA DEPENDABILITY

Wing-type radiators retard collection of dirt, minimizing corrosion. Maintenance is simplified because there is extra room to reach tubes and tank, either for cleaning or repainting.

HELP FOR YOUR SYSTEM—If you have a radial system and expect load density to reach 50 to 100 kva per 100 linear feet within ten years, investigate the advantages of a secondary network. Get in touch with your G-E representative or write to Section 435-14 for Bulletin GET-2432. General Electric Company, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

DISTRIBUTION—Construction

Gin Stick Lifts Capacitor Bank Faster, Safer

A. E. FLAGG, Worcester County Electric Co, Worcester, Mass.

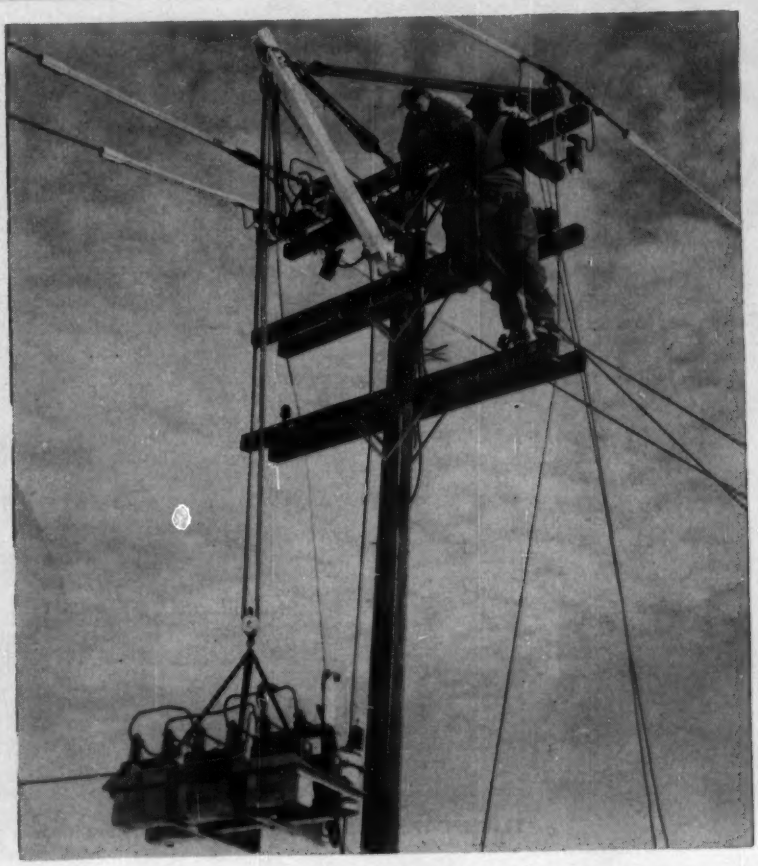
A stiff-leg, maple gin stick speeds the raising of Worcester County Electric Co capacitor banks by damping the sway and guiding them past distribution lines.

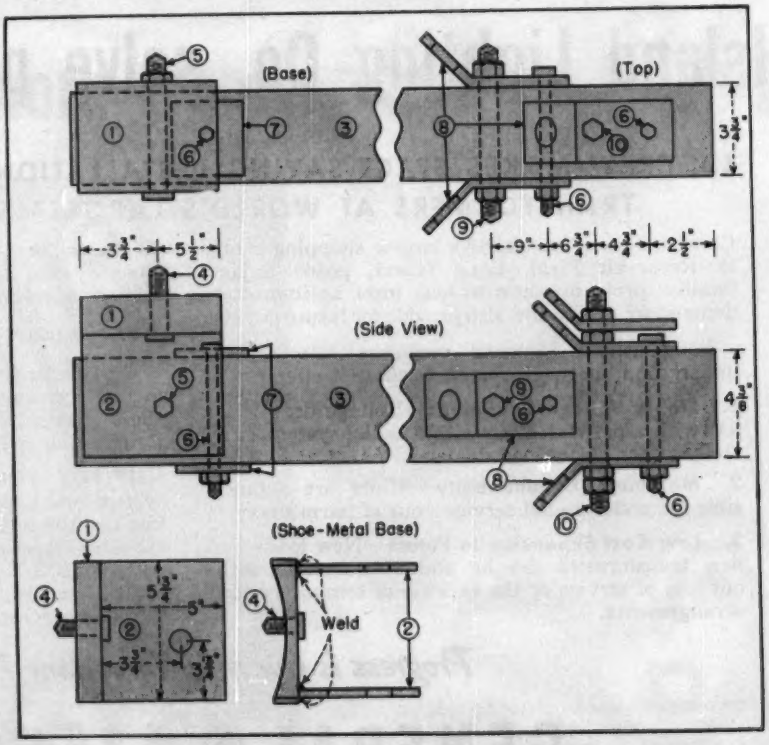
The stick is side-guyed with 4-in. blocks to the space bolts on crossarms, and 6-in. blocks to a guy tongue temporarily attached to the through bolt through the top arms.

When the capacitor bank has been lifted to the proper height by the truck winch, the stick is pulled in to the pole by means of the 6-in. blocks, and the bank is lowered onto the crossarms.

The device worked satisfactorily when tested by a 2,500-lb weight and when used in the field by a line crew. To attach it, a hole is bored in the pole 3.5 in. above the level of the crossarms on which the capacitor bank is to be mounted. A 40-lb shoe is attached to the pole, and the gin is bolted to the shoe. Side-guy blocks and back-supporting blocks are then installed. The 6-in. lifting blocks are hung from the end of the stick, and the capacitors are raised with the niggerhead.

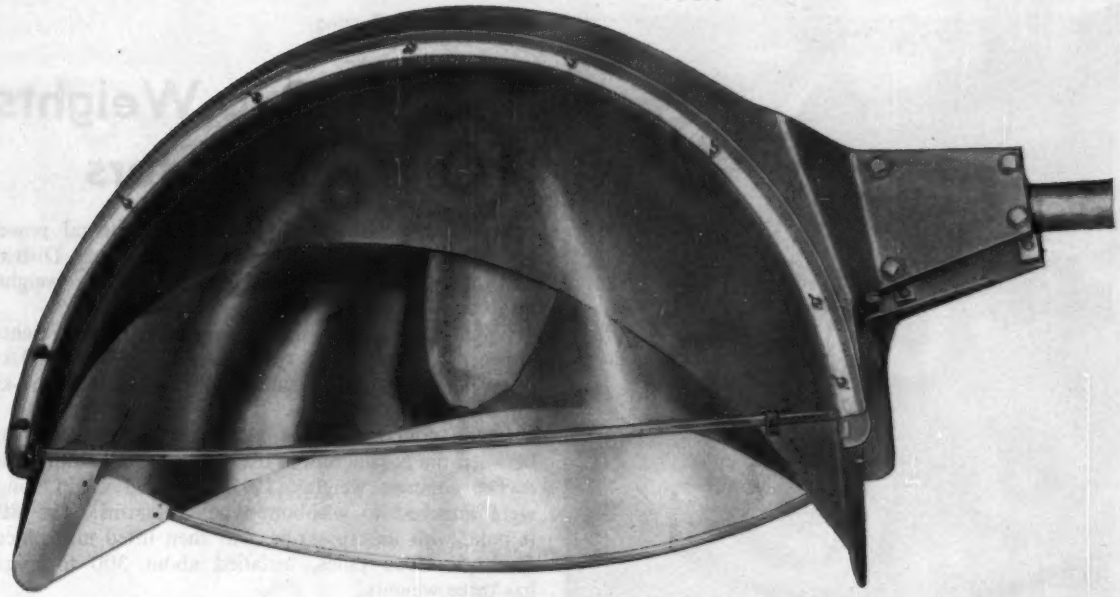
(More How To on page 68)





Key to Drawing

1. 1/2– push brace bracket, malleable iron
2. 5 x 5–3/4 x 3/8–in. steel plate
3. 3–3/4 x 4–3/8 x 76–in. maple gin stick
4. 5/8 x 14–in. through bolt
5. 3/4 x 6–in. through bolt
6. 5/8 x 5–1/2–in. through bolt
7. 3-in. square washer
8. Guy tongue
9. 5/8 x 6–in. bolt
10. 5/8 x 9-in. bolt



NEW *Wheeler* LLB (*linear, low brightness*)

. . . the first low brightness mercury street and highway luminaire!

. . . the first directional luminaire for divided highways and one-way streets!

Wheeler blazes new trails in street and highway lighting . . . introduces the first large, low brightness luminaire that provides all the advantages of elongated (linear) street lighting luminaires *plus* the high efficiency and optical control which no other linear type can give . . . introduces the first practical directional luminaire which slashes energy costs for lighting one-way streets and divided highways by one-half — *Wheeler's contribution to the national highway lighting program.*

The latest example of Wheeler *street lighting pioneering* in action, this 4-ft. long LLB luminaire unit is available in standard I. E. S. street lighting patterns and can be supplied with integrally mounted Fisher-Pierce photoelectric controls. For full information on this sensational new development, see your Wheeler Sales Representative or write today to:

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275 Congress Street, Boston 10, Mass.

STANDARD UNIT

DIRECTIONAL UNIT

END VIEW

WHEELER REPRESENTS THE MOST ADVANCED ENGINEERING IN STREET LIGHTING

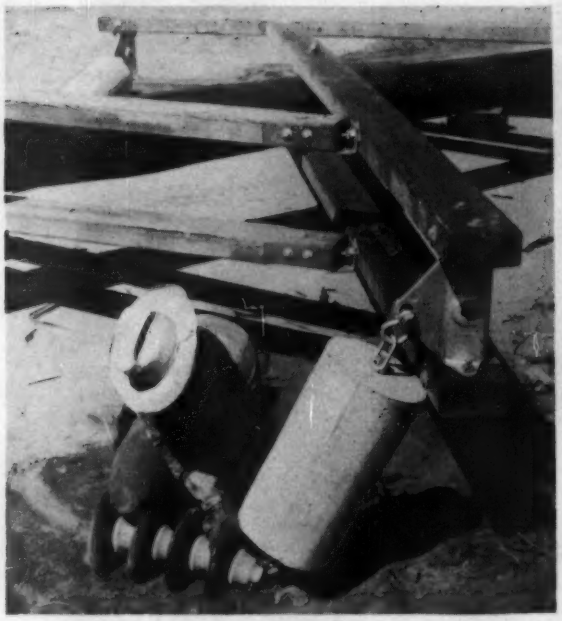


Photo Credit—Salt River Power District Photo

TRANSMISSION—Testing

Arms' 200-lb Weights Simulate Insulators

Pole crossarms in a half-mile experimental power line recently built by the Salt River Power District east of Mesa, Ariz., have 200-lb concrete weights attached.

These heavy attachments make up the difference between the weight of four insulators for the 69-kv line and that of ten insulators for a possible 161-kv line.

These concrete pieces also close the weight gap between the conductors in use and those for future use.

The concrete weights, 12 in. dia and 23 in. long, were attached to wishbone-type crossarms. The 80-ft pole, with its crossarms, was then lifted into place. Each of seven poles, installed about 300 ft apart, has three weights.

Tests for the 161-kv line are expected to continue for at least a year.

TRANSMISSION—Maintenance

Fireproof 'Pants' Preserve Line Structures

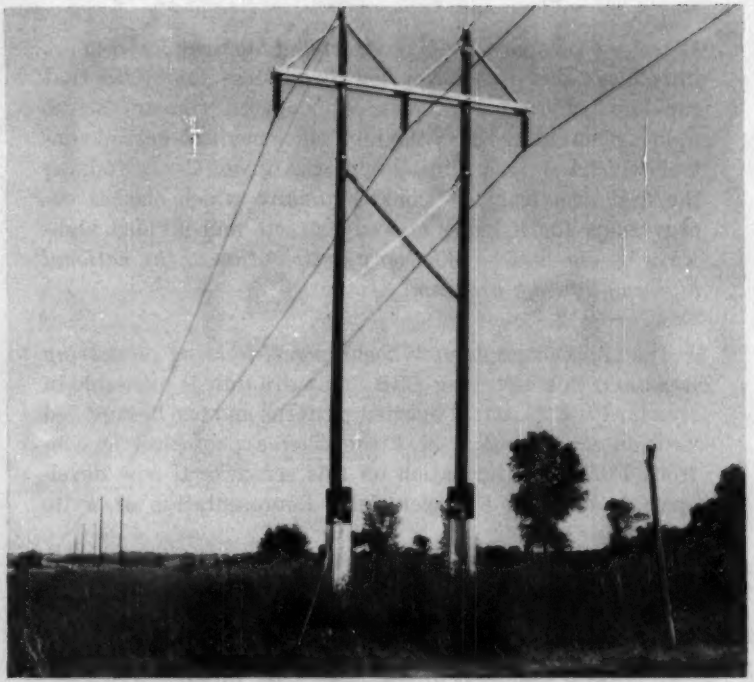
E. B. DOESCHER, Senior Engineer, Northern States Power Co, Minneapolis, Minn.

Transmission-line poles on the edge of a swamp along the Minnesota River are threatened by seasonal grass fires. The H-frame structures are supported by pilings, around which the growth of weeds and marsh grass is heavy and in some places as high as a man's head.

Where poles are stubbed or set on piles, the joint between the stub or pile and the pole acts as a flue. Ignited by a grass fire, the pile structure burns until a space has been opened between the pile and pole which does not support combustion. In one fire, damage was such that the lower section of some structures had to be encased in concrete. After another fire, some H-frame structures with steel towers —also on piles—had to be replaced.

To avoid fire damage, the lower portions of the structures are now

(Continued on page 70)



ALUMINUM SHEETS, or "pants" encase transmission poles in marsh-grass areas where fires formerly damaged the poles. They withstand high temperatures

"Magic Touch"

Lights burn and wheels turn when the magic of electricity surges through industry's life line of high voltage cable. Long, intensive testing has proved beyond question that Simplex ANHYDREX XX insulated cable possesses the stability and resistance that assure long, trouble-free service in all environments. Its amazing resistance to ozone and other oxidizing agents make Simplex ANHYDREX XX the logical choice for your high voltage applications. For complete technical data write for Booklet 1023.

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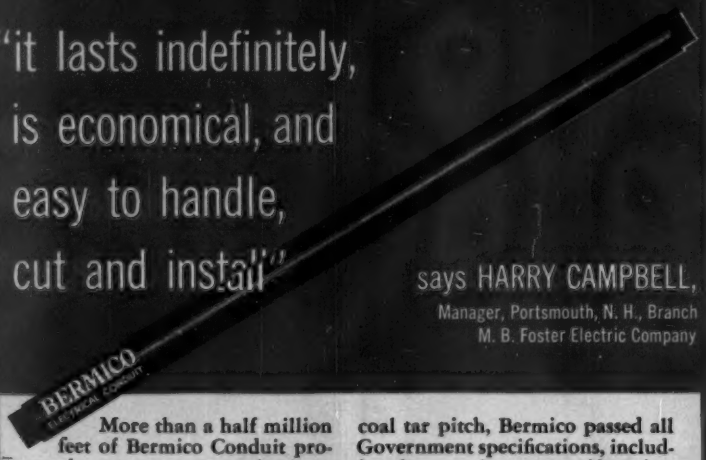
BERMICO® electrical conduit was installed at Portsmouth Air Force Base because...

"it lasts indefinitely, is economical, and easy to handle, cut and install"

says HARRY CAMPBELL,
Manager, Portsmouth, N. H., Branch
M. B. Foster Electric Company



More than a half million feet of Bermico Conduit protect the power, communications, runway-light, and control tower cables at the new Portsmouth Air Force Base in New Hampshire.

This Foster Electric official says he believes Bermico will serve the huge Strategic Air Command Base indefinitely.

Made to precise standards from cellulose fibre impregnated with coal tar pitch, Bermico passed all Government specifications, including heat resistance, uniformity, length-, crushing-, chemical-, and boiling-resistance, plus resistance to water absorption and flattening.

For best protection and utmost ease of installation, do what leading electrical contractors and public utilities everywhere do. Specify Bermico Conduit. Immediate shipment of all sizes and fittings.

Distributed by **WESTINGHOUSE** Electric Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.

Preserve Structures

(*Continued from page* 68)

encased in aluminum sheets 4 by 12 ft, and 0.032-in. thick. Aluminum has heat-reflecting and heat-conducting properties which enable the sheets to withstand rather high temperatures.

During a grass fire, the sheets shield the transmission structure long enough to prevent ignition. As there is very little air inside the tube, ignition there is not likely. The aluminum sheets also resist corrosion at the ground line, and such corrosion would eventually permit air to circulate within the tube as it would in a chimney. Aluminum is ductile and easy to work around the odd shapes of poles and piles.

Must Reach Ground Line

These aluminum sheets were wrapped around the piling and secured with standard, spiral-shanked aluminum roofing nails with neoprene washers.

Investigation of two structures damaged by fire last fall showed that their aluminum protection was 12 to 15 in. above the ground line. Northern States Power Co is confident that, were the aluminum sheets at the ground line, it would have given satisfactory protection.

The company believes that these structures were part of the line built when the ground was frozen. Heaving and subsiding of the soil in winter and spring, respectively, perhaps accounts for the distance between ground line and aluminum protection. Hence, the vulnerability of the two structures.

GENERATION—Maintenance

Foam Lather Detects Leaking Condenser Tubes

Leaking condenser tubes are located easily and quickly by using a foam lather applied to the ends of tubes at the tube sheets. This method and a lather dispenser were developed and are used by Los Angeles Department of Water & Power at its major steam plants.

After half an operating condenser

(*Continued on page* 72)

KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift certificate. Each week a different Kuhlman representative is featured . . . watch for the next Kuhlman "Salesman of the Week."

"WE'LL SERVE YOU BETTER . . . WHEREVER YOU ARE"

Kuhlman's 3 Regional Factories . . . 55 Sales Offices . . . 29 Distributing Centers are strategically located to meet your national and regional transformer requirements.

This map graphically tells the story of how the network of Kuhlman's newly expanded facilities brings you better service—wherever you are. Kuhlman is known for its friendly service—with greater, more personal attention to your local and regional requirements. It is this type of service that helps create the ever-increasing demand for Kuhlman transformers. Ask your friendly Kuhlman representative about the new Kuhlman facilities in your area.

576b

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WALL HEATER

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MILK HOUSE HEATER

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SUSPENSION PORTABLE EXPLOSION PROOF HEATERS

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This is a completely sealed-in **CAST-ALUMINUM HEATING ELEMENT.** Absolutely no glowing elements or exposed open coils. Tops in safety, efficiency and economy. The Electromode heating element is guaranteed for five years.

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For more than a quarter century Electromode has concentrated on one specific industry—heating by electricity. From the beginning Electromode has pioneered for a quality product and has continued to expand its line to include the most modern developments in electric heating equipment to serve present day needs. As a result of Electromode's firm stand on quality, complete satisfaction has been the rule with those who either sell, install or use Electromode electric heating equipment.

MAIL COUPON TODAY

MAIL COUPON! Please send your FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating.

ELECTROMODE Division
Commercial Controls Corporation
Dept. EW-27 45 Crouch Street, Rochester 3, N. Y.

We are interested in ☐ Home ☐ Industrial ☐ Farm

Name.....

Address.....

City.....Zone.....State.....

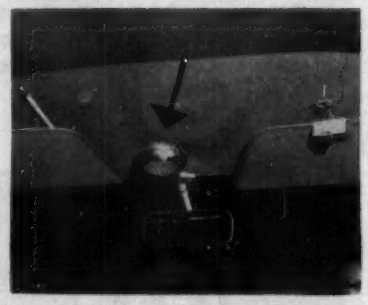
Detects Leaks

(Continued from page 70)

is unwatered, two men enter the shell at either end. They begin applying the lather at the upper corner of the tube sheets and work toward the bottom. The sub-atmospheric pressure inside the condenser sucks the lather into a leaking tube, which is then plugged at both ends.

As a precaution, plugs are tested for leakage. Finally, all tubes are checked for leaks before the condenser half is returned to service. A patent covering the method and use of the dispenser has been sought.

DISTRIBUTION—Operation



Light Helps Trouble-Car Map Reading, Reporting

HAROLD D. KUHN, Radio Engineer, Ohio Power Co, Portsmouth, Ohio

A special utility light has been installed in trouble cars to afford the operators more light for reading maps and filling in reports than would be given by the customary dome lights when the operator is in the driver's seat.

The utility light has been installed on the car's ceiling adjacent to the windshield and rear-view mirror. The fixture is grounded to the car body, and the hot lead is connected through a simple toggle switch to the ignition switch. An automobile utility back-up light, available in supply stores, is used for this special purpose. It was installed in a very short time at less than $3.

This utility light is more convenient than a flashlight for reading maps and writing reports and helps the troubleman perform his tasks more efficiently.

(More How To on page 74)

Get 3 Tanks (A Tank Per Phase)

Even on Outdoor Distribution Breakers

Don't be 1/3 Safe!

● Be completely safe! Buy breakers that offer positive protection for today's low reactance systems with their corresponding high fault currents. Three tanks, not just one, provide maximum protection.

Enjoy this big breaker type protection in outdoor distribution breakers at no extra charge. Other big breaker features include: AEIC-NEMA standardized control wiring; two vertical breaks per phase, using time-tested *Ruptor* devices; self-aligning, self-wiping tulip and bayonet contacts.

Ask for Bulletin 71B7946 for the complete story. Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Ruptor is an Allis-Chalmers trademark.

NATIONAL ELECTRICAL week
FEB. 10-16, 1957

Ratings: 14.4 kv, 100 and 250 mva

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5146

What Makes RT&E Transformers Better?

OUTSTANDING COIL DESIGN

High Overload Capacity
High Impulse Strength

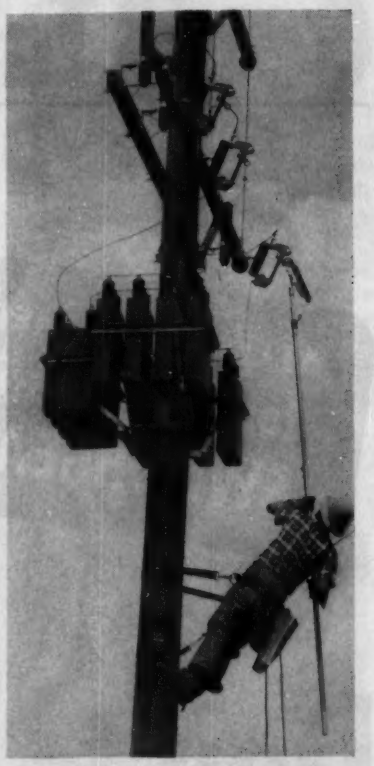
RT&E core-type construction, combining maximum cooling surfaces with careful placement of oil ducts at critical points, results in faster cooling and a greater-than-average overload capacity. Mechanical strength of coils is enhanced with top quality varnish impregnation.

Kiln-dried maple oil duct spacers
Rigid pressed board fillers
Heavy transformer board separators
Space wound end layers
High calendered virgin Kraft insulation
Stepped type windings

Impulse strength in excess of NEMA standards, due to stepped-type windings and space wound layers, insures adequate impulse strength throughout the life of the Transformer.

RT&E CORPORATION
WAUKESHA, WISCONSIN

OUTSTANDING COIL DESIGN — *Another reason why* **RT&E** *is better!*



PORTABLE INTERRUPTER SWITCH is used for breaking circuit at capacitor installations which are equipped only with conventional disconnect switches

Special Switch Breaks Pole Capacitor Circuit

To reduce the cost of providing interrupter switches for its many capacitor installations, Dayton Power & Light Co installs a conventional fused open-type cutout with which a portable interrupter tool on a switch stick can be used to break the circuit. Used by a lineman, the interrupter tool hooks onto the cutout in such a manner that it bypasses the fuse tube.

Pulling on the switch stick opens the cutout, and the load current is transferred from the fuse tube to the interrupter tool. More pulling breaks the load current in the interrupter unit of the tool. The tool and the fuse tube can then be removed.

The next fused cutout is then opened similarly.

Savings are commensurate with the number of interrupter switches not required.

Steve's writing new pole specifications because...

PENTA-treated poles last longer, handle easier

As construction and maintenance superintendent, I'm plenty interested in knowing that we're using the best materials we can get. Saves me trouble in installation and maintenance. That's why I went in and asked Steve —he's our specification engineer—how the specs on the PENTA-treated poles were coming along.

Steve said the specifications were in the works but he wanted to know two things—why should we change at all, and why the hurry.

That was my opening. I told him about PENTA's proven long life, the better public relations, the no extra cost, the ready availability and all the other improvements.

And I pointed out that most joint-use poles were PENTA-treated and that utilities installed nearly 1½ million PENTA-treated poles last year. Then Steve broke in. He said he knew all that, but why was I so enthused about PENTA as a wood preservative.

So I confessed that it was really the men in the line crews I was thinking about. They want PENTA-treated poles now, because they are much cleaner and easier to handle. Well, we're getting the specs all right and we'll be using PENTA-treated poles in our new line.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department PE 984A-1.

YOU CAN DEPEND ON DOW

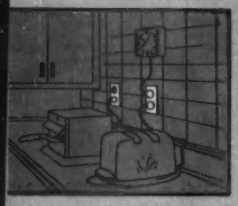
Of the 1,531 NYC Apartment Women Surveyed . . . .

Larger Kitchens

More than ⅓ want larger kitchens. Average kitchen is 78 sq ft — husband's office is 180 sq ft.

Kitchen Lighting

40% want over-sink lighting. Light level is 75% below IES recommendation.

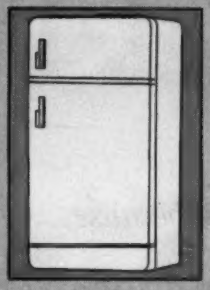


Outlets and Wiring

⅔ don't have enough kitchen appliance outlets. More than half want strip-type outlets.

Refrigerators

Most want larger refrigerators. Average size is 7 cu ft; they feel they need about 9 cu ft.

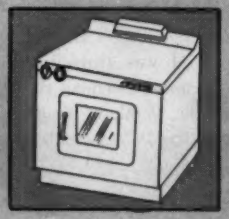


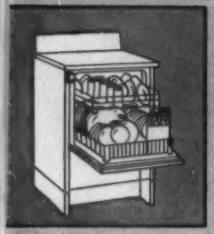
Ranges

99% have gas ranges, but about 34% would take an electric range if they had a choice.

Home Laundries

17% have a clothes dryer. 40% want automatic washers. 50% want washer-dryer combined.





Dishwashers

Only one in 30 has an electric dishwasher. About 40% want one. 25% will pay more to get it.

Apartment Ladies Tell Con Ed Their Story: Better Electrical Living

Survey finds women in NYC apartments want same things as women in own homes

Consolidated Edison Co's recent "So We Asked the Ladies" survey holds a lesson for every other utility in the country: there's simply nothing like good old market research.

Con Ed position is unique among utilities. A very large percentage—70%, in fact—of its residential customers live in apartment houses. The company set out to find out just what these women wanted in the way of modern living conveniences, and whether or not their desires differed from those of people who live in private homes.

According to the survey, the details of which are summarized in a 14-page booklet entitled "So We Asked the Ladies", housewives in New York City apartments want the same beauty, utility and conveniences in their kitchens as their counterparts in private homes. Furthermore, they are willing to pay for what they want.

As a result there exists in NYC an opportunity for other groups to benefit. Landlords, by providing the desired apartment features, get greater tenant stability, There is a known but untapped market for manufacturers, distributors, dealers and contractors. The survey also revealed that in most respects these desires are not being met; nor is there an evident trend toward improvement.

Some of the things that the Con Ed survey revealed the ladies want are:

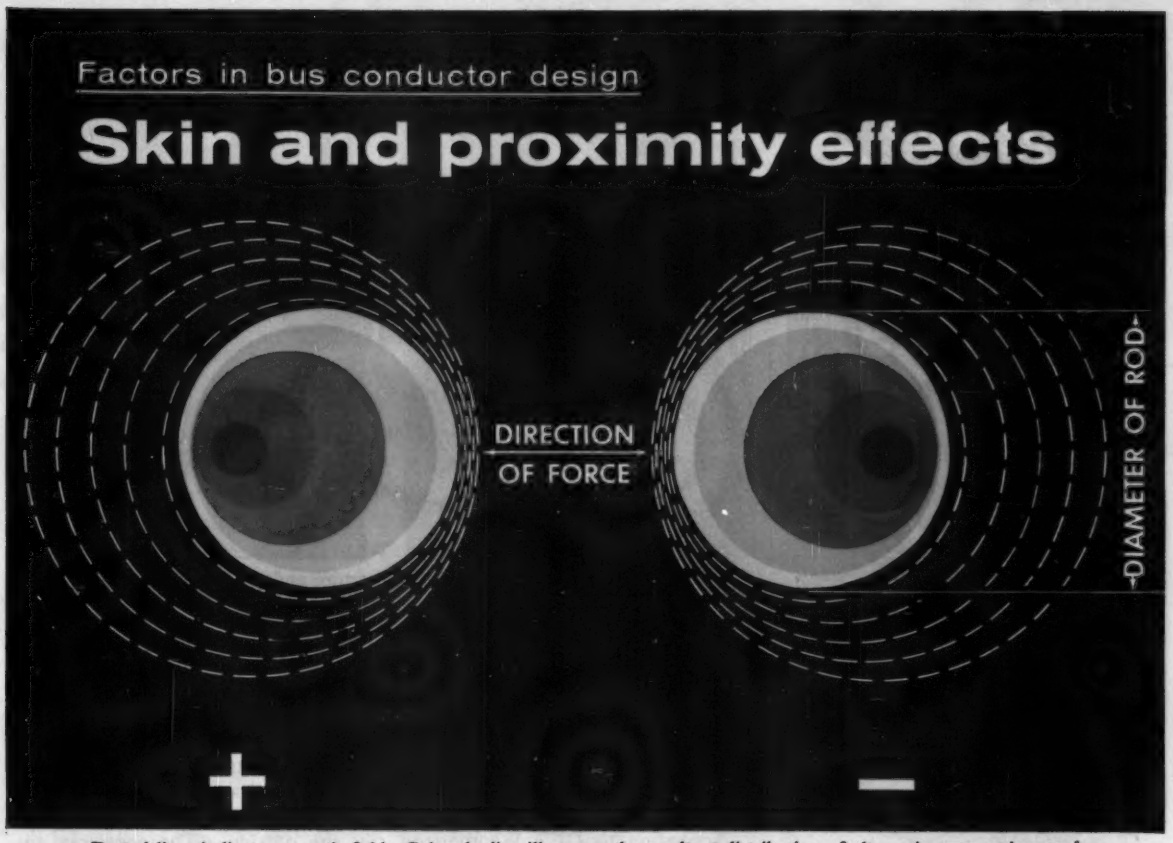
- More kitchen space. Average kitchen area surveyed was 78 sq ft. Those who were satisfied have 84 sq ft. Those who complained have only 67 sq ft. Husband's office area averages 180 sq ft.
- Dining space in the kitchen; only 60% now have it.
- At least 7 ft of counter space. The average apartment has only 3 ft. More storage space for appliances is also wanted.
- Better lighting. Lighting in the average NYC apartment is 10.2 ft-candles, 75% below the IES recommendation of 40 ft-candles.
- Over-the-sink lighting. Only 4% have it now. 34% want lighting over the range, and 14% would like under-cabinet lighting.
- More outlets, especially for kitchen appliances. More than half the women asked want plug-in, strip-type outlets over the counter.
- More appliances, including larger refrigerators, electric ranges, dishwashers and home laundries.

As a result of this survey, Con Ed has established an Apartment House Division to advise on kitchen design and other electrical features for New York's "cliff dwellers."

(More Selling on page 78)

Factors in bus conductor design

Skin and proximity effects



Dotted lines indicate magnetic fields. Color shading illustrates the resultant distribution of alternating current in round rod conductors. Mechanical force is developed as the centers of current try to move into the centers of their magnetic fields.

Low skin-effect ratio favors tubular shape

Skin effect becomes increasingly important in the medium and larger sizes of bus conductors carrying alternating current. It is the basic reason for using tubular conductors, quite apart from the structural advantages which they also possess. Tubular shapes (round or square) and paired channels have low skin-effect ratios, i.e., low effective resistance to alternating current.

Skin effect is, essentially, the crowding of the main alternating current flowing in a conductor toward the outside surface by a contrary flow induced in the center of a solid conductor, a cable, or in the inner annular area of a tubular conductor by the constantly varying magnetic flux surrounding it.

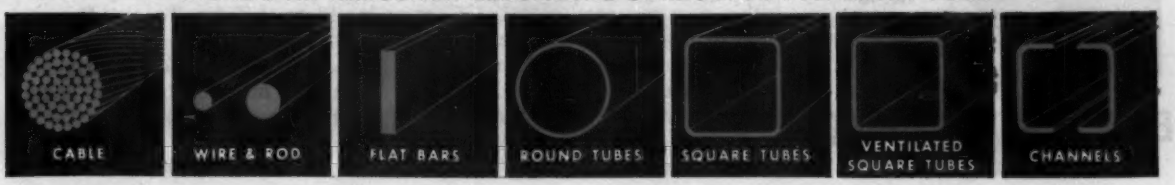
Proximity effect is uneven distribution of an electrical current over the cross section of a conductor due to distortion of the surrounding magnetic field by the field or fields generated by current in neighboring conductors. The practical result of "proximity" is an increase in the apparent resistances of the conductors affected. Mechanical forces also are generated.

Field and current distribution problems are two of the many which complicate bus design. The Technical Department of The American Brass Company is always available to engineers for consultation in the selection of Bus Conductors for specific needs. See your Anaconda representative, or address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

8799

ANACONDA® COPPER CONDUCTORS

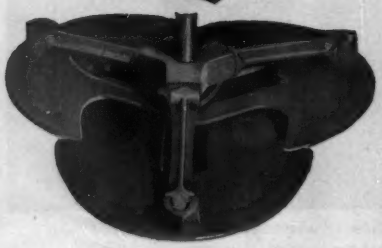
THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

OUTSIDE AND INSIDE, the new GE Weathertron makes a compact A.C. package

GE Introduces Home Builder Heat Pump

The first heat pump designed specifically for the home builder market, a General Electric Weathertron, was introduced at the recent National Home Builders Show in Chicago.

According to GE's Weathertron Department in Bloomfield, N. J., the new air-to-air heat pump is 50% smaller and one third less in weight than any previous model. It's efficiency at the same time is said to have been increased by 17% in its heating and 32% in its cooling performance compared with earlier models. The new unit was designed to be competitively priced for use in the larger builder market.

GE says that it was the first time in the history of the National Association of Home Builders Show that a packaged heat pump, large enough for an entire home, has been exhibited.

Spokesmen for the company said that merchant builders during 1957 will turn more and more to the latest home improvements in order to merchandise and sell the homes they build. Previously, heat pumps were only in the more expensively built homes, but with the introduction of this new compact model, GE expects to see more heat pumps used in the large home builder projects throughout the country.

The size of the new Weathertron makes it suitable for slab or crawl space home construction. It is 30½ x 36⅞ x 46 in., and has a total weight of 560 lb. It serves as a horizontal, vertical or down-flow air conditioning system. Servicing can be taken care from either the inside or the outside. The accessory return air grille and filters can be located remotely from the unit when it is installed in a space that leaves little clearance or is relatively inaccessible. Placed on the outside wall, it can be installed so as to project as little as 14 in. into the home.

It can also handle air distribution for ductless applications. The new unit is said to have sufficient capacity for small round duct air-wall tape systems.

GE says the Weathertron can be put in the bottom of a linen closet or suspended in a garage over a workbench or in a basement above the home laundry. Further applications would be in the attic, crawl space, on the roof or on the ground, feeding into an outside wall distribution system.

General Electric also exhibited the first new home air cooled unit to roll off the assembly lines at its new $15 million Home Heating & Cooling Plant at Tyler, Texas. Reportedly, when the new plant reaches full capacity, it will be able to manufacture as many central units as the entire industry produced in 1956.

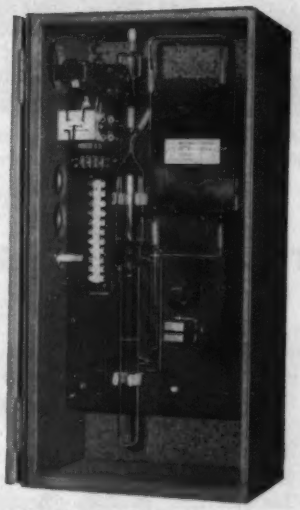
(More Selling on page 80)

for more precise measurement . . .

K&M EBONIZED ASBESTOS

K&M Ebonized Asbestos, used for mounting panels, has exceptionally high dielectric strength. It is made of inorganic materials, pressure-molded and impregnated with a special insulating compound. It has high mechanical strength that makes components stay put and provides great resistance to vibration, shock, and temperature changes. Its uniform density and relatively light weight make it easy to handle and machine.

K&M Ebonized Asbestos is ideal where strong, shatterproof insulating material is required . . . on switchboards, bus bar supports, cabinets, compartment linings, bench boards and testing tables.



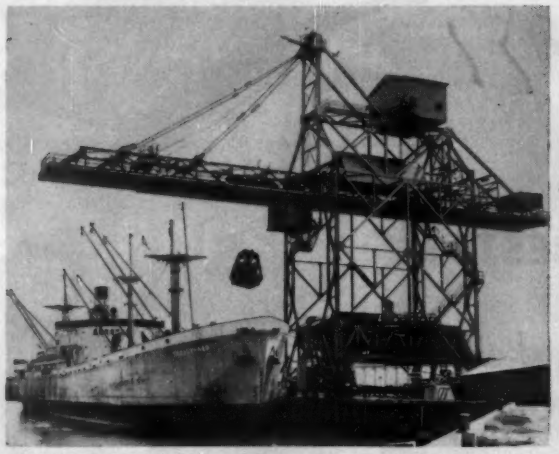
This Leeds & Northrup Gas Analysis Equipment is mounted on K&M Ebonized Asbestos to help ensure precise electrical measurement and longer life.

Write for information on K&M Ebonized Asbestos and other outstanding K&M insulating materials including Monobestos, K&M asbestos cloth, tapes, and tubing for electrical equipment.

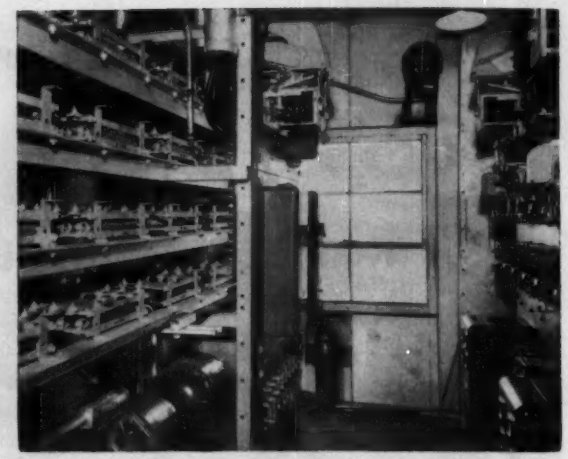
KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

In Canada: Atlas Asbestos Company, Limited; Montreal, Toronto, Winnipeg, Edmonton, Vancouver

K&M Last in Asbestos ®



ORE UNLOADER with overdriven motors, rotating amplifier control for trolley and bucket handles 1700 tons/hr



SMALLER, FEWER CONTACTORS, absence of accelerating resistors make trolley control room cooler, lighter, roomier

Motor Drive Trims Power, Maintenance Costs

K. E. LEWIS, Electrical Engineer, Engineering Works Div., Dravo Corp., Pittsburgh, Pa.

An adjustable voltage motor drive system cuts power costs and maintenance for a new Mobile, Alabama iron ore unloader. A small rotating amplifier generates an adjustable d-c voltage to control the trolley and bucket motors. Large contactors and accelerating resistors, with their inherently large I^2R losses, are eliminated. Controls for the motors are smaller and lighter. Another special feature of the unloader is the use of sturdy mill motors driven at almost twice rated voltage to increase effective hp and reduce motor size,

Owned by Tennessee Coal & Iron Div. of US Steel, the unloader transfers South American ore from ocean-going vessels to a conveyor. It consists of a rectangular steel tower, 65 ft by 45 ft, mounted on tracks to allow it to move the length of a 960-ft pier. On a runway at the tower top, 78 ft above the pier, a self-propelled man trolley travels between the vessel and the 3,000-cu. ft. hopper of the conveyor. A 275-cu. ft. clam-shell bucket, suspended from the trolley has a free-digging rate of 1700 tons per hour.

Trolley and bucket drive motors spend much of their time accelerating and decelerating and may make as many as 100 speed changes per hour. In a conventional constant voltage system, power not wanted at the motor terminals is wasted as heat in the control room. Accelerators and resistors must be able to carry full motor current. Maintenance, replacement rates are high.

Boost Effective Hp

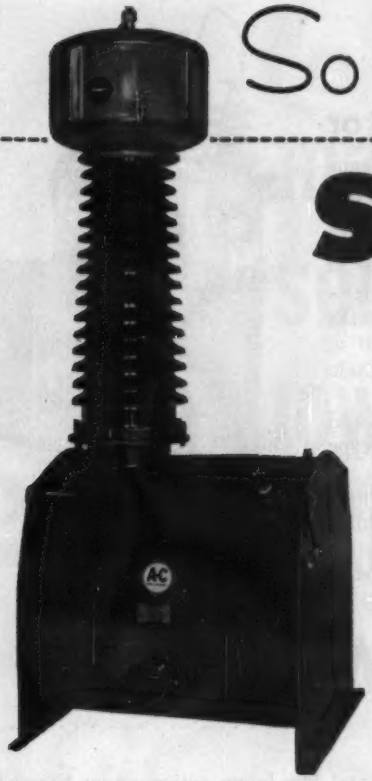
With the adjustable system, only the voltage required at the motor terminals is supplied. Smooth, rapid acceleration is assured as well as better current and voltage control, load division, and speed matching. Trolley weight is cut by elimination of bulky acceleration resistors and by reducing the number and size of contactors used. Smaller I^2R losses reduce the ventilating capacity required for the control compartment.

The two trolley motors and the bucket hold and close line motors are all shunt-wound, mill-type machines, nominally rated for 230-v operation. Because mill motors are sturdily built, satisfactory commutation characteristics can be obtained at voltages almost twice normal rating. When 420-v is applied to a nominal 230-v motor, it runs at a much greater speed with no loss in torque. This increase in effective hp means a motor one frame size smaller than normal often can be used.

Shunt fields of the trolley and hoist motors are connected to a constant voltage source. Armature voltage is varied to control speed. Main power for the motors is obtained from four d-c generators driven by a 800-hp, 2300-v, 3-phase, 60-cps synchronous motor. One of these generators, a 150-kw compound-wound unit, delivers a fixed 250 v to operate control panels, the tower travel drive, and auxiliary drive motors. Output of the other three generators each rated 300 kw can be varied from zero to 420 vdc, according to excitation from the rotating amplifier.

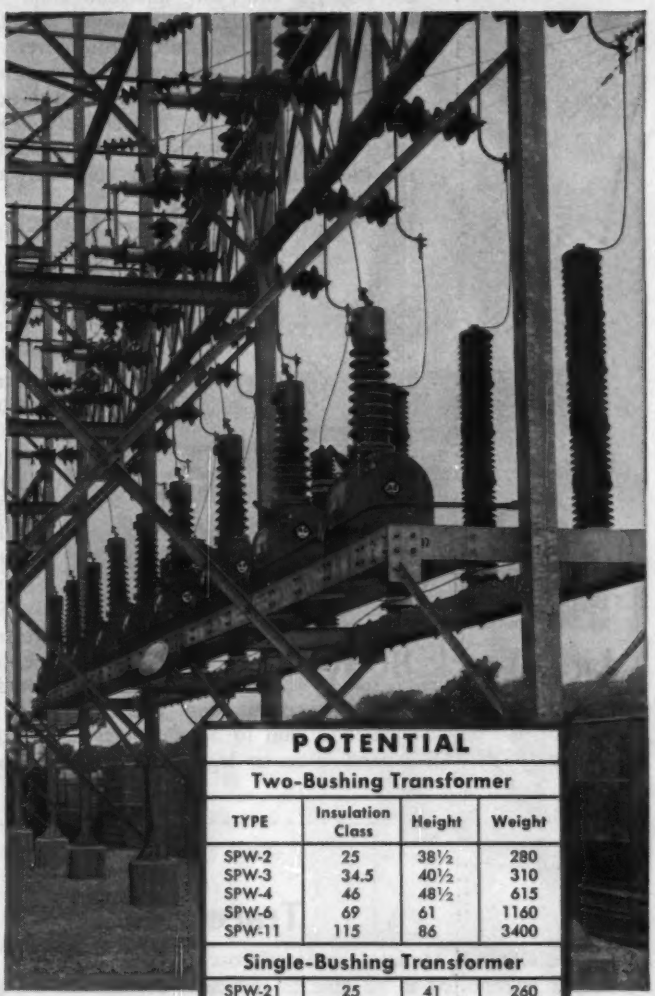
The rotating amplifier, driven by a 440-v, 1800-rpm, 15-hp squirrel cage motor, is a small d-c generator with several field windings. Each field is sensitive to a specific condition, such as voltage, current, speed, or the operator's signal.

One of the three variable voltage generators provides armature voltage for the two 125-hp, 485-rpm trolley drive motors which are electrically and mechanically connected in parallel. Another supplies voltage for the 187.5-hp hold line drive motor and the third feeds the similar close line motor.



So Light...SO COMPACT

So *Easy* to Install



MUCH smaller and lighter than previous designs, new Allis-Chalmers potential transformers cut installation costs and provide maximum handling convenience. Less space and less foundation to mounting structure are required. A fork truck or block and tackle is all that is needed to lift these 69-kv units into position. And, of course, relocating is accomplished just as easily.

Performance has also been improved in both ratio and phase angle with the advanced design of Allis-Chalmers potential transformers.

Many other design features — features that assure unparalleled dependability and long life — have been incorporated in these modern units. Get the complete story from your local A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

POTENTIAL			
Two-Bushing Transformer			
TYPE	Insulation Class	Height	Weight
SPW-2	25	38½	280
SPW-3	34.5	40½	310
SPW-4	46	48½	615
SPW-6	69	61	1160
SPW-11	115	86	3400
Single-Bushing Transformer			
SPW-21	25	41	260
SPW-31	34.5	44¼	285
SPW-41	46	50¾	460
SPW-61	69	63¾	950
SPW-111	115	92	2310
SPW-131	138	112	3510

NATIONAL ELECTRICAL Week
FEB. 10-16, 1957

New Ratings have been added to the Allis-Chalmers line of potential transformers to include higher voltage insulation classes.

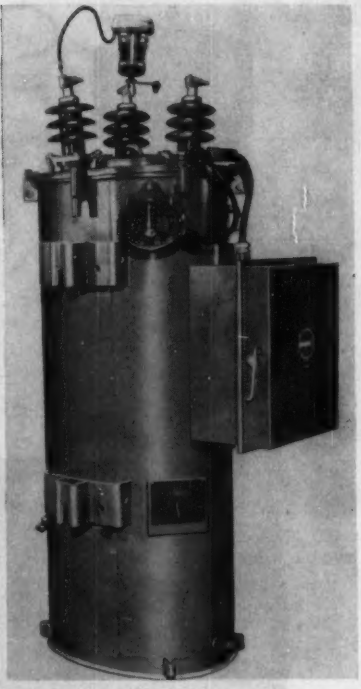
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5164

NEW EQUIPMENT

Voltage Regulator



This type RDS single-phase, pole-type voltage regulator is reported to cover a range of ±10% in 32 steps of 5/8% each. Manufacturer claims it operates at 160% rated current when externally adjustable limit switches are reset to cut range to ±5%.

Intended for circuits rated 2,400 to 7,200 v delta or 2,400/4,160 to 7,960/13,800 v wye, the RDS is available in ranges of 2,500, 5,000 and 7,620 v. Current ratings depend on voltage class and include 25, 50, 75, 100, 150, and 200 amp.

The motor-driven tap changer and the core and coil assembly are suspended from cover. A valve-type lightning arrester protects the series winding.

The regulator control has Class I accuracy, may be mounted integrally or remotely. Other features are a line drop compensator, an adjustable integrating time delay, a contact making voltmeter, and an operation counter.

Line Material Co, Milwaukee 1, Wis.

Line Truck Body

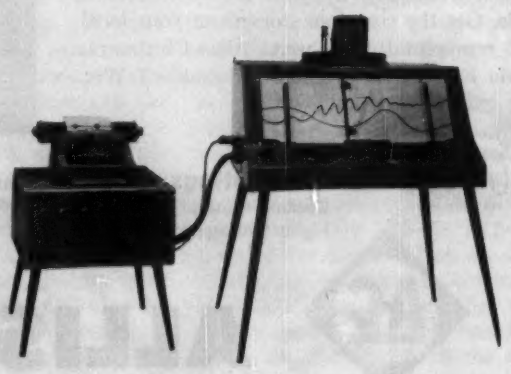
This model BC 146C line construction truck body has a 29-ft derrick which is said to handle poles as long as 65 ft. An expanding center leg assures maximum safety and live boom action under heavy loads. Manufacturer claims derrick capacity is limited only by weight of truck front end. A ground prop and foot plate are said to reduce need for a pole pulling jack.

A hydraulic digger bores vertical or angular holes with diameters up to 22 in. Down pressures of approximately 4,000 lb are claimed. Hydraulic valves on rear of truck control digger.

Self-storing hydraulic jacks can level truck or add extra support at rear. A 10-ton winch may be driven either by a shaft take-off for heavy jobs or by a hydraulic auxiliary for more precise control. A 3-kw a-c generator, driven by the truck engine, supplies both auxiliary power tools and flood lights.

York-Hoover Corp, York, Pa.

Trace Reader

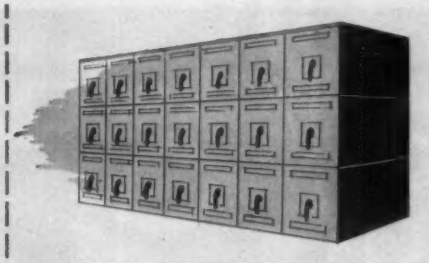


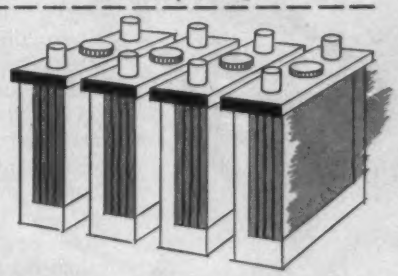
The OSCAR Model J automatic oscillograph trace reader is reported to be able to reduce trace records from paper or film, either opaque or transparent. It is said to apply linear and non-linear calibration factors automatically. Curvilinear coordinates are automatically translated to rectangular form. Output range is from 0 to 999, with reported accuracy of 0.1% of full scale. Maximum range is one point of data per sec.

Benson-Lehner Corp, 11930 Olympic Blvd., Los Angeles 64, Cal.

(More new equipment on page 84)

make reserve power positive power





It's common practice to depend on storage batteries whenever *power must not fail.* But, dependable as storage batteries are, you have to be sure they are *ready* to deliver power at a moment's notice . . . any time. Your best insurance of such readiness is an INET-Palmer *Regulated* Battery Charger. Completely unattended, they guard your reserve batteries against sulfation and discharge . . . make sure 24 hours a day that standby power, on those once-a-year occasions when it's needed, is ready for immediate use.

6 reasons why your best buy is an INET-Palmer *regulated* charger...

COMPLETELY AUTOMATIC . . . operates unattended; no operator required.

DEPENDABLE . . . no moving parts or vacuum tubes used in circuits.

STABLE . . . less than ±1% variation from no-load to full-load despite ±10% simultaneous input variation.

EASY INSTALLATION . . . floor (right), wall (left), or panel models available.

WIDE RATING RANGE . . . 3 to 60 cells in ratings to 50 KW.

LOW OPERATING COST . . . nothing to wear out, nothing to maintain.

LEACH CORPORATION | INET-PALMER DIVISION

Write for Bulletin T-1100. It gives pictures, ratings, sizes, descriptions of the complete INET-Palmer Charger line. Write for it today.

4441 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA

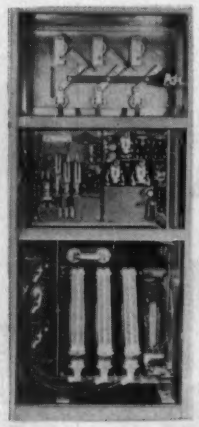
DISTRICT OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES OF U. S. AND CANADA

PORTABLE PHASE ANGLE METER

Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ in. Weight 19 lbs.

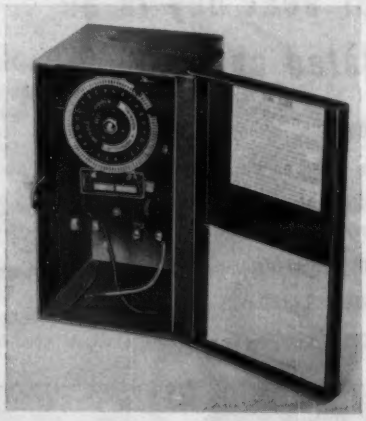
Also available in other voltage combinations.
Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.



High Voltage Starter

A line of NEMA Class E-1 high-voltage air-break starters with an interrupting capacity of 50 Mva feature contactors that replace current-limiting fuses. According to GE engineers, the starter may be readily converted to provide a maximum interrupting capacity of 150 Mva at 2,300 v and 250 Mva at 4,000 or 4,600 v. Unit is said to be entirely front-connected, and requires a minimum floor area. Measures 30 in. deep by 38 in. wide by 90 in. high. Has a roll-out contactor, gang-operated disconnect switch, and a maximum rating of approximately 3,000 hp at 4,600 v.
General Electric Co, Industry Control Dept, Roanoke, Va.

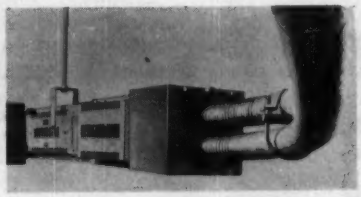


Three-Pole Time Switch

This redesigned and improved 3-pole time switch (Model 1963) offers a choice of four dials . . . regular 24-hr dial, skip-a-day dial (for eliminating weekend operation), astronomic dial (for lighting to conform with the sun's schedule), and a 7-day dial (to program an entire week's varied schedule on one dial) . . . in enclosures suited for the particular installation. May be used to switch three separate 120-v circuits leading from a sub-panel or to control a 1.5-hp 3-phase motor directly.
Tork Clock Co, Mount Vernon, N. Y.

Screen Room

A line of Champion, double-isolated screen rooms, available in custom or standard sizes, is claimed to provide 100-db attenuation from 200 kc to 1000 Mc. Made of interchangeable panels, the rooms are said to be easily disassembled for relocation.
Erik A. Lindgren & Assoc. Inc., 4515 N. Ravenswood Blvd., Chicago 40, Ill.



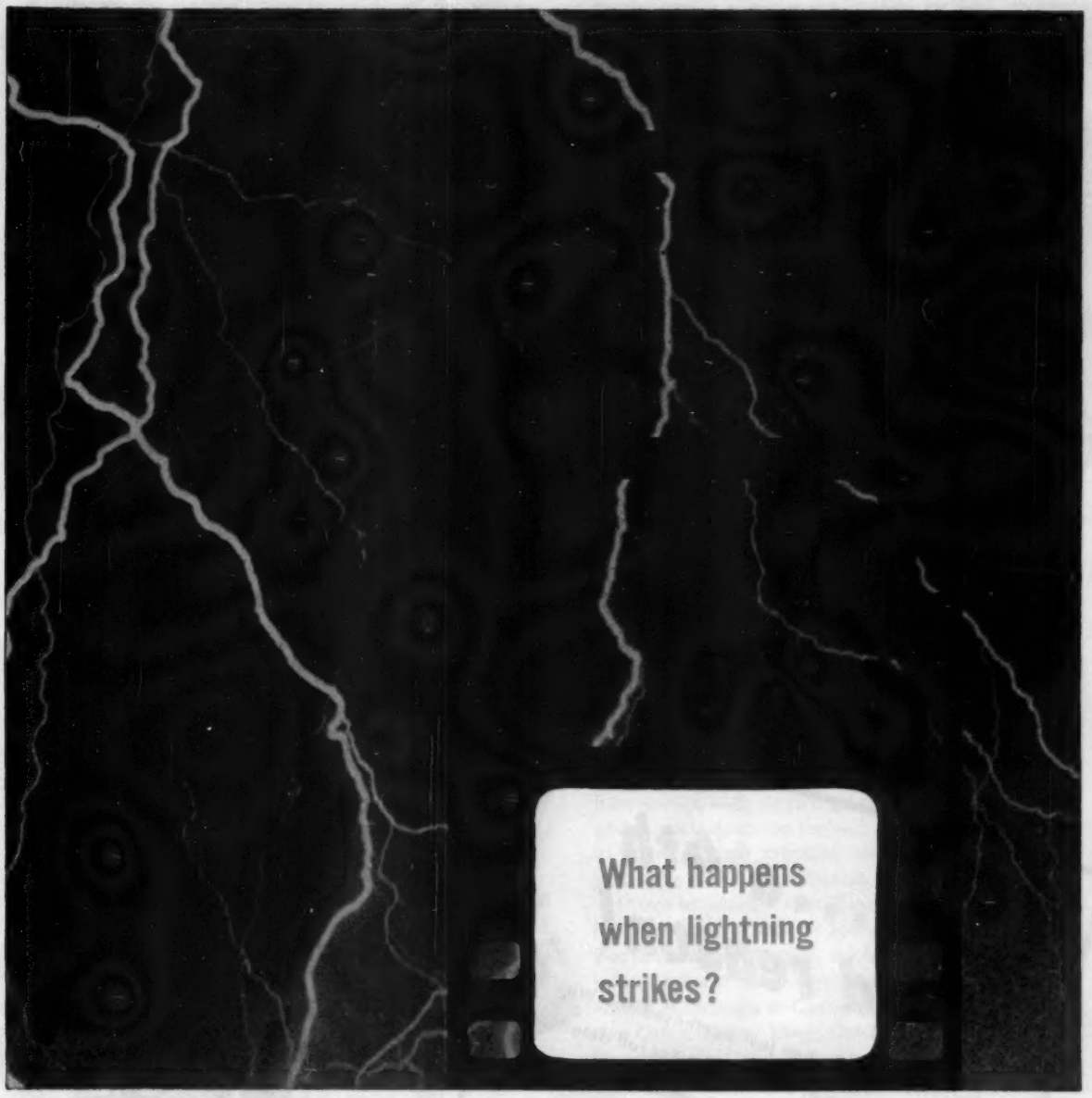
Bus Duct

A Uni-bus power distribution system, consisting of two attachment boxes joined by flexible conduit and cable, is reported to combine low impedance characteristics and plug-in construction. Interlocked plug-in opening covers can not be removed until circuit is opened by switch or breaker. Bus bars are covered until plug-ins are fastened in place.

According to the manufacturer, phase collection at each joint provides load equalization and high short-circuit strength with approved ratings up to 50,000 amp rms.

Busways are available in copper or aluminum with single run ratings of 225, 400, and 600 amp in 2, 3, and 4-pole housings. An 800-amp rating is available in copper only.
Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.

(*More New Equipment on page* 88)



New Hubbard Film Demonstrates Lightning Arrester Operation

The subject of power system lightning protection is complex and difficult to explain by conventional methods. This film, using new techniques of animation and ultra-high speed photography, facilitates the understanding of the many variables entering into the problem of lightning protection.

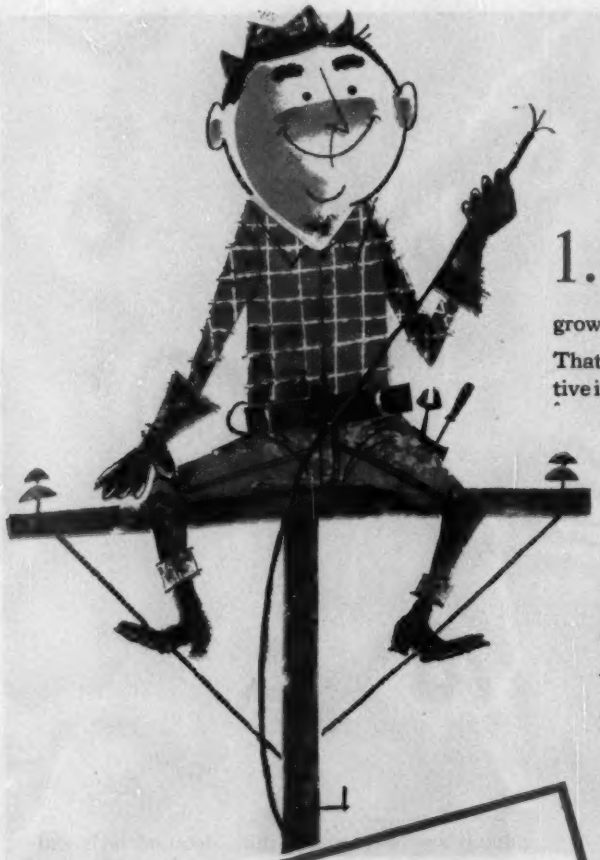
Produced in the Hubbard Research Laboratories especially for utility personnel, this film entitled "The Magic Cylinder" details formation of natural lightning, the effects of lightning on a power system, the duty on arresters, and the operational characteristics of the types in current use.

In full color and sound, with running time of 28 minutes, the picture is without counterpart in its educational coverage of this complex subject.

You can arrange for a showing of this brand new color film by contacting the Advertising Department of Hubbard and Company, 6301 Butler Street, Pittsburgh 1, Pennsylvania.

HUBBARD AND COMPANY

Pittsburgh 1, Pa. • Chicago, Ill. • Oakland, Calif. • Plano (Dallas), Texas



1. *Tops on the power pole!*

Kaiser Aluminum is the nation's fastest growing producer of aluminum wire and cable.

That means we can give you the latest authoritative information on modern products and practices.

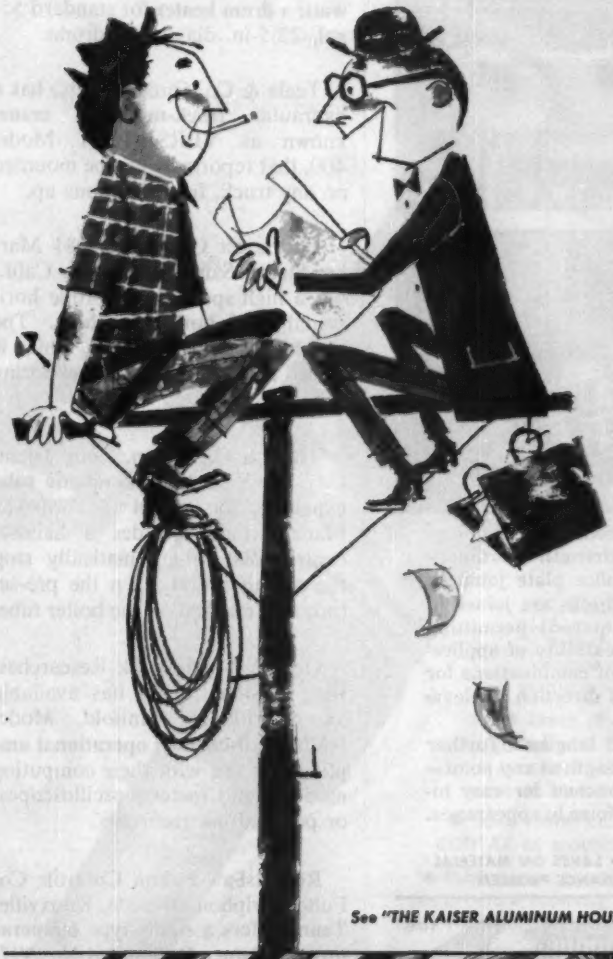
2. *We bend over backwards to serve you!*

That means that you can depend on delivery of your order—wherever and whenever you need it.

Now...a 4th good reason!

Kaiser Aluminum has just purchased the Wire & Cable Division of U. S. Rubber. For full details, contact any Kaiser Aluminum sales office.

3 good reasons why you should see Kaiser Aluminum first



3. *Our field service is the talk of the industry!*

Kaiser Aluminum field men will work hand-in-hand with your crews—will give you alert and expert service.

That means your linemen learn, first-hand, ways to speed installations and cut costs. Kaiser Aluminum engineers will furnish detailed technical information such as stringing sag tables and sag-and-tension charts on request, will work with you in power system planning and design, will help you solve specific installation problems.

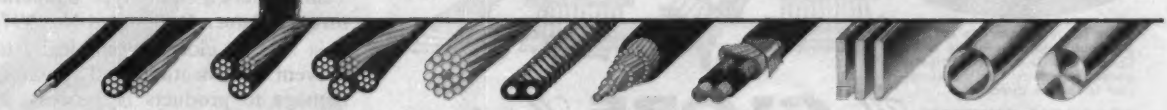
Prove to yourself that Kaiser Aluminum service is the kind of service you've been looking for. For immediate attention, contact any Kaiser Aluminum sales office or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc. *Executive Office,* Kaiser Bldg., Oakland 12, California; *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois.

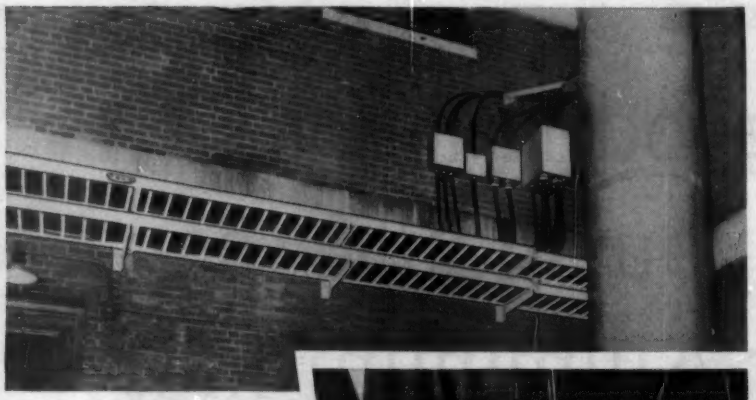
Kaiser Aluminum

Aluminum is the answer to Adequate Wiring

FIRST... TRY KAISER KW WIRE®

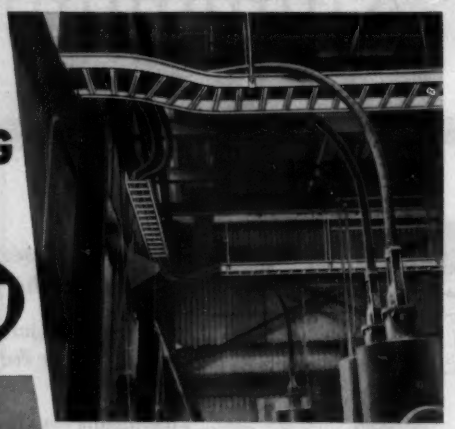
See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

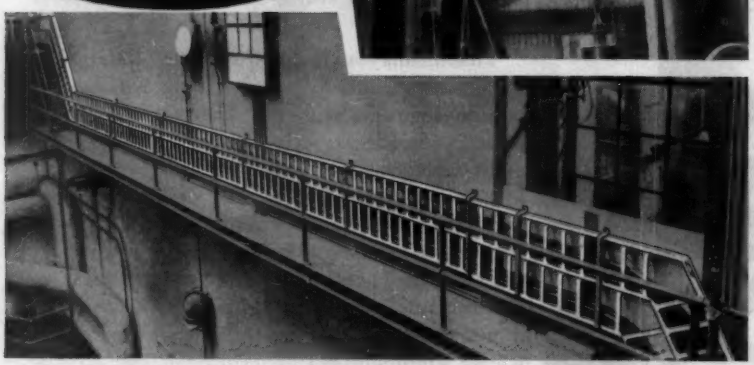




a new, superior system of CABLE and TUBING RACE WAYS...

Globetray
PAT. PENDING





A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Globetray
THE GLOBE COMPANY

EASY TO INSTALL • SAVES TIME • SAVES ON MATERIAL
GALVANIZED • NO MAINTENANCE PROBLEM

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

PRODUCTS DIVISION The GLOBE Company
4030 S. PRINCETON AVE. • CHICAGO 9, ILL.

More New Products

International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill., has expanded its line of "all-wheel-drive" **trucks** through the addition of four 6-wheel-drive models and two 4-wheel drive models.

Crouse-Hinds Co., Wolf and Seventh Sts., Syracuse, N. Y. offers two sizes series VM VaporMaster **vapor-tight lighting fixtures** which handle lamps up to 300 w, are easily interchangeable, and have an all-in-one aluminum socket, globe holder and guard.

Acra Electric Corp., Franklin Park, Ill., offers a 2,500-w and a 3,000-w model of the RH-1 Acra-watt, a **drum heater** for standard 55-gal, 22.5-in. diam steel drums.

Teale & Co, Omaha, Neb., has a hydraulic **truck-mounted crane,** known as VERSA-LIFT Model 400, that reportedly can be mounted on any truck, from 1½ tons up.

Hydrauger Corp, Ltd, 681 Market Street, San Francisco 5, Calif., has a high speed, high torque horizontal **earth-boring machine.** The tool bit is cooled by water, which is forced through a hollow steel boring bar.

Thomas C. Wilson, Long Island City, N. Y., has a **pneumatic tube expander,** the Model C Torq-Air-Matic, which includes a handset control dial to automatically stop the rolling action when the pre-set torque is reached on the boiler tube.

George A. Philbrick Researches, Inc., Boston, Mass., has available an operational manifold, Model HKR, a **10-channel operational amplifier** for use with their computing modules and meters, oscilloscopes, or pen and ink recorders.

Robertshaw-Fulton Controls Co, Fulton Sylphon Division, Knoxville, Tenn., offers a safety-type **temperature regulator.** Designated No. 997, it is said to close automatically to prevent overheating and possible damage to products in process, in the event a thermostatic unit is accidentally damaged.

WHAT

BLACKBURN

HAS

UP

ITS

SLEEVE!

Blackburn Compression Service Entrance Sleeves Feature

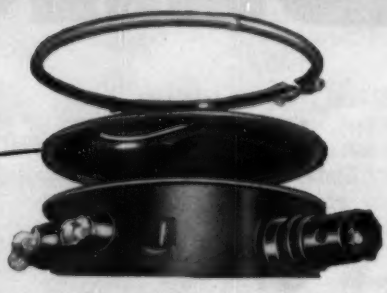
- Body of highly conductive aluminum that fits all standard compression tools. Can be used for all combinations of aluminum ACSR and copper conductors.
- Bores of each tube are filled with CONTAX, a mineral base grease with metallic and abrasive particles held in suspension. It has an ASTM drop point of 549° F.—improves conductivity—prevents corrosion.
- Solid metal barrier between bores assures even distribution of CONTAX all around conductors when crimps are made.
- Push conductor through thin wall, color coded caps—no need to remove them before inserting conductor—they do not interfere with installing die. Colors will not run or fade. Sizes cover a wide range of conductor combinations.

Available at Electrical Wholesalers Everywhere.
Wire or write for bulletin on Blackburn Compression Fittings.

JASPER BLACKBURN CORPORATION 35 MADISON ST. • ST. LOUIS 6, MO. • PHONE MAIN 1-2821

WAGNER FORM W Pole Type

offer all the mechanical you need for EASIER INSTALLATION...



SHUR-SEAL CLAMPING RING
Sealing gasket, held in place by retaining ring on cover, is uniformly compressed around entire circumference. Keeps transformer sealed air tight . . . no atmospheric moisture or dust particles can get inside. "Breathing" is completely prevented. Yet the cover may be easily removed by loosening a single bolt.

HIGH VOLTAGE SIDEWALL BUSHING
Permits the use of either copper or aluminum conductor. Insulating knob is designed for safer, faster, easier connections, without tools. Porcelain and terminal are locked in position.

LOCKED LOW VOLTAGE BUSHING
The bushing and terminal are key-locked to prevent turning when terminals are tightened. Eliminates loose terminal connections that could cause internal short circuits. Takes either copper or aluminum conductor.

Wagner maintains a nationwide organization to provide fast convenient service, with branches in 32 principal cities.

Bulletin TU-141 gives complete information on Wagner Distribution Transformers. Write for your file copy today.

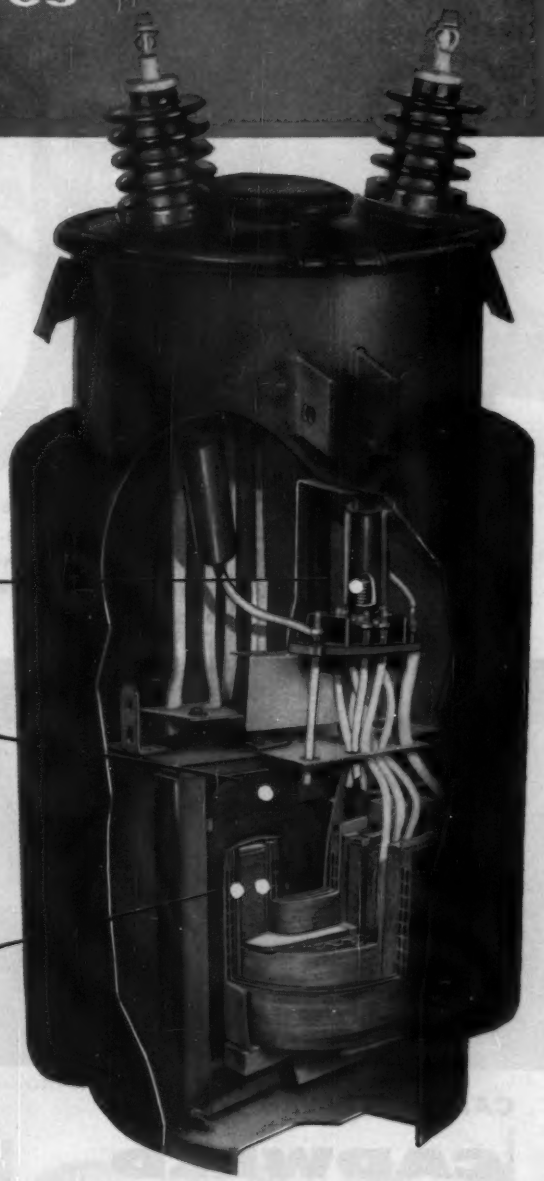
Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

ELECTRIC MOTORS • TRANSFORMERS

DISTRIBUTION TRANSFORMERS

and electrical features

LONGER SERVICE LIFE!



Wagner Form W Distribution Transformers are exactly right for modern distribution systems. Their small size and light weight make them easy to handle—to store—to mount on poles.

Form W Transformers come in a complete range of single-phase ratings, 500 kva and smaller, 69 KV and below. All Form W Transformers, in ratings 3 through 167 kva, 15 KV and below, are designed for pole mounting.

You can choose either conventional or protected type Form W Transformers for your distribution lines with full confidence that they will pay dividends in longer service life.

ROTARY TAP CHANGER ●

Positive action . . . pre-loaded spring maintains constant pressure between the moving contact and the tap studs.

FORM W CONSTRUCTION ●

CORES are of cold rolled oriented grain transformer steel, cut into two turn sections, which are assembled through and around the coils.

COILS are wound of pure copper wire or strip, with high dielectric insulating material between layers in the high and low voltage windings. Insulation has crimped edges to hold windings accurately in place to permanently maintain electrical clearances.

BONDED INSULATION ●

An improved thermo-setting material for layer, channel and barrier insulation is bonded to the coil conductors to give the coils great mechanical and electrical strength.

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Wagner Electric Corporation

6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

of connecting two—
350 MCM copper cables to three—
250 MCM flexible copper braids. The braids in turn are connected to 1-1/4" nichrome rods. CADWELD'S versatility of design and outstanding electrical properties solved the problem.

YOUR electrical connection problem due to:

1. Conductor construction
2. Type of conductor material
3. Overload and surge currents
4. Corrosive conditions
5. High ambient temperature

CAN BE SOLVED WITH . . .

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CATALOGS—BULLETINS

• **INDUSTRIAL APPARAL:** Their line of acid and caustic-resistant industrial apparal made of DuPont Orlon and Union Carbide's Dynel is covered in a catalog issued by Worklon, Inc, 253 W. 28th Street, New York 1, N. Y.

• **MAGNETIC LAMINATIONS:** The manufacturer has issued a 4-page supplement to his Catalog ML-201 describing his magnetic laminations. Both catalog and supplement are available from Magnetics, Inc, Butler, Pa.

• **TRANSFORMER BANKS:** "Primary Fusing of Parallel-Connected Transformer Banks" is the name of a bulletin on the subject issued by S & C Electric Co. 4435 Ravenswood Ave, Chicago 40, Ill.

• **WELD FITTINGS:** "Weld Fittings for Tubular Aluminum Bus", bulletin AW 50, describes the new fittings for field welding of aluminum bus developed by Penn-Union Electric Corp, Erie, Pa.

• **RECEPTACLES:** Its line of receptacles, wall and wiring devices is covered in detail in a set of publications, numbered as AIA File 31-C-7, published by Sierra Electric Corp, 15100 S. Figuero Street, Gardena, Calif.

• **REFRACTORY CASTABLE:** A 4-page bulletin describes Kaocrete, B&W's refractory castable in boiler ashpits. Write Babcox & Wilcox Co, 161 E. 42nd Street, New York 17, N. Y.

• **PANEL METERS:** A 6-page panel meter bulletin, No. 2057, contains descriptions and specifications of over 800 models available from Simpson Electric Co, 5200 W. Kinzie St, Chicago 44, Ill.

• **TOOL STEELS:** A 52-page catalog of tool steels lists the brand names of the major manufacturers along with the industrial and government specifications of their respective tool steels. This information is cross-indexed. Burke Steel Co, P. O. Box 514, Rochester, N. Y.

• **BRUSH & COMMUTATOR MAINTENANCE:** A short booklet on brush and commutator maintenance contains practical information on the subject. Write Technical Publicity Dept, Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

• **ENCLOSED TROLLEY BUSWAY ELECTRIFICATION:** Bulletin No. 37, known as "Safe Electrification for Your Moving Test Lines", details the advantages of the manufacturer's Feedrail System of enclosed trolley busway electrification for testing. Feedrail Corp, 125 Barclay Street, New York 7, N. Y.

• **ELECTRIC POWER PLANTS:** A 36-page catalog describes the complete line of Gen-A-Matic portable, standby and sole power electric plants; self-priming and diaphragm pumps; earth boring machines; and 2-way flasher lights made by Gen-A-Matic Corp, 14741 Bessemer Street, Van Nuys, Calif.

• **OIL-TIGHT CONTROL UNITS:** Oil-tight control units, including push buttons, indicating lights, selector switches, covers and enclosures, etc, are described in a 28-page catalog entitled "Master Design" published recently by Cutler-Hammer, Inc, Dept EE-120, 315 N. 12th Street, Milwaukee 1, Wis.

BOOKS

New Light on Physics

Introduction to Solid State Physics—2nd Edition. By Charles Kittel. Published by John Wiley & Sons, 440 Fourth Avenue, New York 16, N. Y. 617 pages, illustrated. Price $12.00.

A thoroughly exacting text concerned with the physical properties of solids, particularly the special properties exhibited by atoms and molecules because of their association and regular period arrangement in crystals, this second edition includes fuller explanation of the basic concepts. New material has also been added on diffusion, dislocations, alloys, semiconductors, photoconductivity, luminescence, and imperfections in solids.

The book is intended as an introductory text in solid state physics for physics, chemistry, and engineering students. Knowledge of quantum mechanics is not considered necessary, but familiarity with several modern physics theories—beyond the scope of the average utility engineer's work—appears necessary.

Measurement Theory

Applied Electrical Measurements. By Isaac F. Kinnard. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 600 pages, illustrated. Price, $15.00.

Detailed coverage of the theory and application of electrical measurements is provided by this book. It was prepared by a practicing instrument engineer with contributions from 14 other engineers active in the field.

Emphasis is on the application of measurement fundamentals rather than on the use of measuring instruments in industrial applications. In fact only one chapter is devoted to this subject. And this section of the book is brief and rather sketchy.

The book is divided into two parts: Part I covers measurement of electrical quantities; Part II covers measurement of non-electrical quantities by electrical means. By way of introduction the author discusses the history and theory of electrical measurements before presenting material on such electrical quantities as: current, potential difference, impedance, power, and energy. Non-electrical quantities treated are light, heat, sound, statics, kinetics, liquids, gases, and time.

The fundamental physics underlying the theory of every measurement technique is discussed. The book is well planned, logically arranged, and adequately illustrated. A brief chapter is devoted to telemetering but only scant mention is made of servomechanisms. This should not be considered a detriment, however, because both of these topics deal to a large extent with application and because extensive treatment would be beyond the physical limitations of the book size.

When that new substation is delayed for lack of switchgear or connectors, *somebody's* on the spot. To avoid this situation, place your order with Royal.

Whenever delivery is an important factor, be sure . . . call Royal *first!* Royal's compact operation is purposely kept flexible —so each order gets custom service and *delivery when needed.* Every one of our customers get this "Royal treatment" . . . it's a customer pledge we live by.

Whether your job is normal or rush, large or small, you'll like dealing with Royal — for switchgear, any of 5,000 standard connectors, or specially engineered designs. Next time, save time and trouble — order from Royal Electric.

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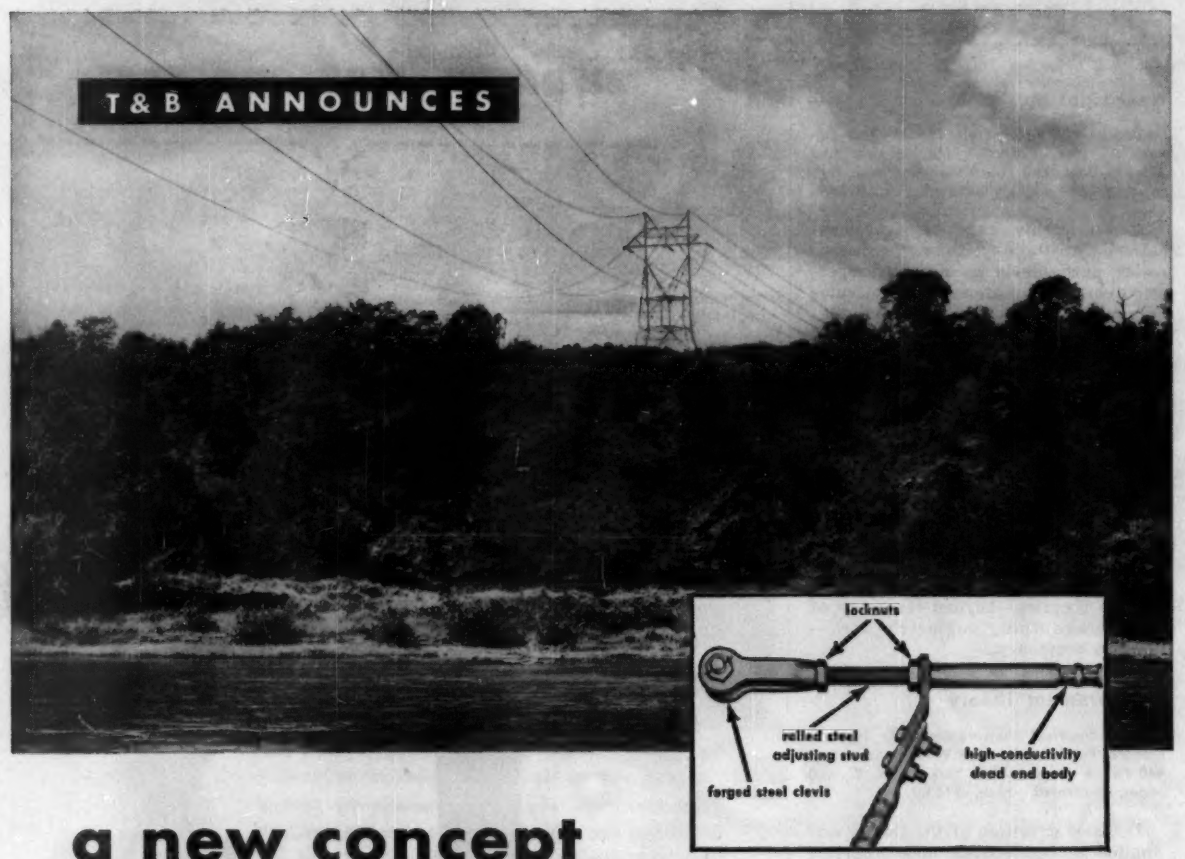
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices



a new concept in transmission dead ending!

DEAD END CONNECTORS PERMIT SAG CORRECTION AFTER JOINT IS COMPLETED

Now you can adjust conductor sag to specification after the strain connection has been made! Four inches of clevis adjustment available provides great sag adjustment. For example: in a 700 foot span of 795,000 CM A.C.S.R. sagged at 50% of ultimate strength, the 4 inch clevis adjustment will allow 4 feet of sag adjustment.

The new dead end connector gives many important advantages: transmission line dead ending at river crossing and over rough terrain is simplified, more economical; "bundled" cables can be easily sagged with complete uniformity; line measurement errors can be readily compensated.

T&B Dead Ends are available for all commercial sizes of A.C.S.R. and all-aluminum conductors in three types: single bolting pad, double bolting pad, and with an integral compression loop connection.

For complete specifications on the new dead ends, as well as the complete new catalog of T&B Method transmission line connectors, tools and accessories, send the coupon below.

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

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Please send me the new T&B Method Bulletin 70

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Company_____

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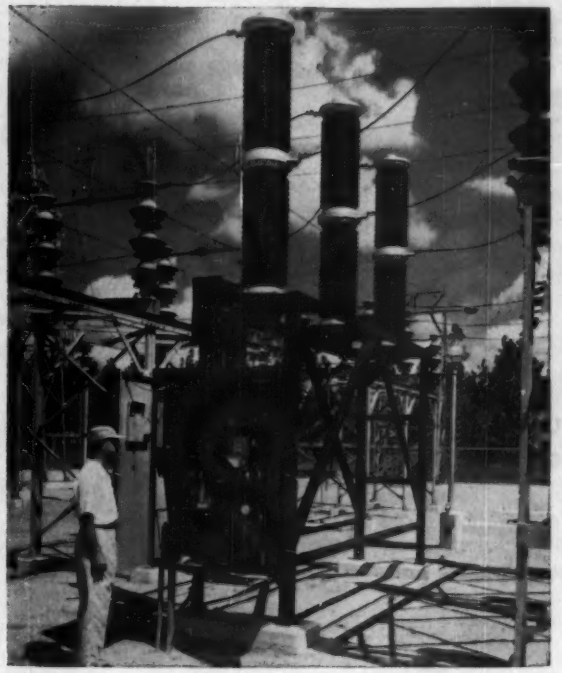

Westinghouse Builds Three New SF_6-Filled Breakers

Westinghouse Electric Corp recently built three radically new type circuit breakers and installed them for experimental use. The breakers, which differ from previous designs principally in that they use sulphur hexafluoride gas (SF_6) for insulation and arc interruption rather than oil or air, have been installed at a Gulf Power Co substation at Pensacola, Fla.

These units are rated 115 kv, 400 amp continuous, 1,000 Mva interrupting capacity. Gas is used at 45 psig.

The 115-kv circuit breakers are said to weigh less than oil breakers of comparable capacity, and it is hoped that they will cost less to manufacture. Their simple construction and rugged design reportedly makes it possible to operate them with a minimum amount of maintenance.

The quenching action of the sulphur hexafluoride is described as one in which the gas "soaks" up the arc's electrons, much the same as a sponge soaks up water. Quenching and reclosing reportedly occurs in ⅓ sec. Westinghouse claims the interrupting performance, including elimination of "restrikes," is equal to their best breakers of other types.

SMS Making 4 Turbines for Minas Gerais, Brazil

S. Morgan Smith Co of York, Pa., is producing equipment for two hydro-electric developments on the Rio Grande River in the State of Minas Gerais, Brazil. Each is for Centrias Electricas de Minas Gerais. Equipment was purchased by Ebasco International Corp for CEMG.

For the Itutinga Plant two 20,000-hp fixed blade propeller turbines with 13-ft plate steel spiral cases will be furnished. These 115-in. vertical turbines are designed to operate at 225 rpm under 98-ft head. Shipment of the parts will begin about August and continue until the end of the year.

Already included in this installation are SMS head gates, draft tube gates, 1075-hp turbine for station service and two Smith-Kaplan turbines, each rated 17,000 hp.

For the Camargos Plant two 30,000 hp Smith-Kaplan turbines, will be mounted vertically in concrete semi-spiral cases. These 152-in. units will operate at 150 rpm under a 72.2-ft. rated head. Shipment is scheduled for autumn of 1957 through late spring of 1958.

Other SMS equipment for the Camargos plant includes Tainter gate hoists and 10-ft trash rack rake. Tainter gates, intake gates and an emergency sluice gate are being designed by SMS engineers for construction in Brazil.

GE Develops New Line of Polyphase Meters

General Electric Co has developed a new family of polyphase meters. Designated V-60, they are reported to give a high degree of precision over a great range of loads in line with the trend toward such meters. Polyphase meters are now required to register accurately under loads up to 667% of current rating in order to measure today's loads, as well as those of the future.

GE's new meter is also said to minimize inventories and standardize testing procedures by being suitable for operating voltages on conventional 208, 240 and 277-v circuits without recalibration. Reportedly, they make longer test periods possible by providing greater sustained accuracy through the introduction of magnetic rotor suspension to polyphase metering.

Other features of the new V-60's include: Accuracy unaffected by tilt; quieter operation; "surge relief gap" to control point of flashover and provide lightning protection on those meters rated at 120 and 240 v; and high accuracy under fluctuations of temperature and power factor.

Chance Co to Acquire American Crossarm Co

A. B. Chance Co, Centralia, Mo., has contracted to acquire the American Crossarm and Conduit Co, Chicago, and its subsidiaries. Closing of negotiations is expected to be completed in about a month.

F. Gano Chance, president and chairman of the board of the Missouri firm, said the transaction will involve an exchange of Chance common shares for all of the American

(Continued on page 96)

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push it under streets, roads, tracks, lawns with a timesaving

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Two feet per minute average pushing time

GREENLEE Pushers are available in two sizes: No. 790 for ¾" to 4" pipe . . . No. 795 for pipe over 4", concrete sewer pipe, large ducts. Average performance of No. 790, shown above with power pump, two feet per minute. Write for literature.

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1802 Columbia Avenue • Rockford, Illinois

Chance Co

(Continued from page 95)

Crossarm & Conduit capital stock.

American Crossarm will be operated as a wholly owned subsidiary. Frederick A. Masterson, present vice president and secretary, will become president. Russell E. Paulson is treasurer.

Chance Co manufacturers pole line equipment, including hardware used with crossarms and in pole guying. American Crossarm produces crossarms, braces, and other wooden components for pole line construction.

U. S. Rubber Consumption, 1956 is Second High Year

Consumption of new rubber in the United States during 1956 amounted to 1,440,272 long tons, the second highest year on record, according to the January rubber report of the Rubber Manufacturers Association, Inc, New York.

Highest consumption level recorded was a year ago when 1,529,699 long tons were consumed. Of the total new rubber used during 1956, synthetic rubbers of all types accounted for 60.90% or 877,094 tons; during 1955 this ratio was 58.50% and represented 894,899 tons.

Production of synthetic rubbers during 1956 amounted to 1,079,695 tons, an increase of more than 100,000 tons over 1955 when 970,468 tons were produced in domestic plants.

Reclaimed rubber consumption for the year is estimated at 271,827 tons as compared with the 312,781 tons consumed a year ago.

During December, 1956, total new rubber consumption was 118,152 long tons; in November it was 114,735 tons.

CE Makes Large Shipment to Spain

These boiler drums and fuel burners built by Combustion Engineering Inc, made up a portion of the reportedly largest single peacetime shipment of boiler material from the Port of New York. Destined for four ports in Spain—Almeria, Barcelona, Cadiz, and Malaga—the shipment weighed over 2.7 million lb. It required 62 railroad cars and 10 trailer trucks for transport from the plant to New York City.

The equipment will become part of Spain's $120 million power expansion program. For this program Combustion Engineering is supplying 12 boilers for seven steam power plants. The boilers range in steam capacity from 80,000 lb per hr to 300,000 lb per hr (equivalent 7,500 kw to 30,000 kw) for steam conditions up to 900 psig at 900F.

Complete shipment of all boiler equipment is scheduled for July 1.

Cable Job Slated

. . . for San Francisco-Hawaii telephone link. Simplex Wire & Cable to supply big portion

Laying of two 2,300 nautical mile submarine telephone cables between San Francisco and Hawaii begins this spring. The job will incorporate advances in cable-construction and laying art which have been tested the past several years. Supplier for the major portion of the twin-cable link is Simplex Wire & Cable Co, Cambridge, Mass.

Joint cable development by Simplex and Bell Telephone Laboratories and progress on electronic repeater systems by the Laboratories have already led to installation of some 4,600 nautical miles of underwater cable systems. These include two 120-nautical mile cables between Key West, Fla., and Havana, Cuba, which were the prototypes of deep sea repeatered-cable; and a part of the transatlantic crossing from Newfoundland to Scotland. In addition, a twin-cable line between Port Angeles, Wash., and Ketchikan, Alaska, was completed in December, 1956.

The Atlantic and Alaska lines carry 36 conversations simultaneously, as will the Pacific cable.

A-C Boston Works Trucked Large Breaker Assembled

The largest oil circuit breaker to be shipped by truck to-date from Allis-Chalmers Boston Works is a completely assembled 115-kv, 800-amp, 1,500-Mva interrupting capacity outdoor unit. The type BZO breaker was transported to a substation of a New England utility.

A low trailer was used in shipping the unit which weighed about 10.5 tons and measured about 13.5 ft high. Special deflectors were attached to the breaker's bushings as a safeguard against low overhead wires. The bushings were also specially wrapped to protect them from possible damage by tree branches along the way.

A second unit was trucked a few days later. Both were ready for installation on arrival at destination.

PAGE chain link FENCE

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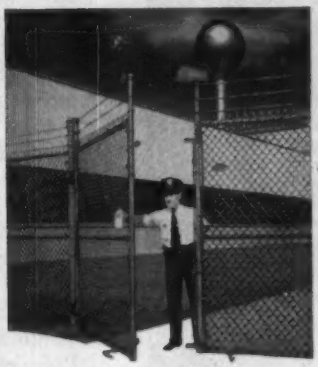

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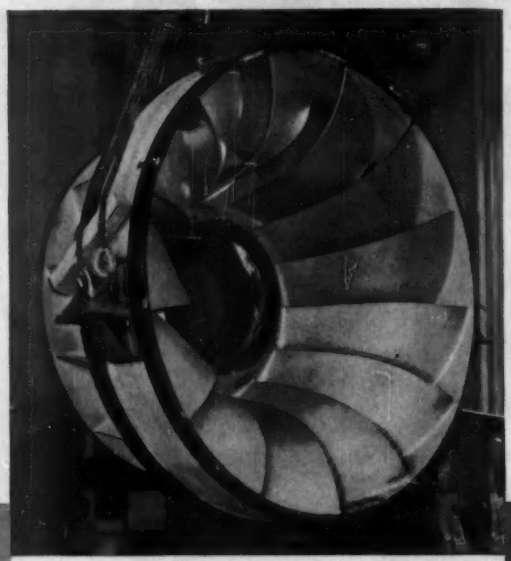
BEATRICE NEBRASKA

Two more giant B-L-H turbines for Garrison Dam

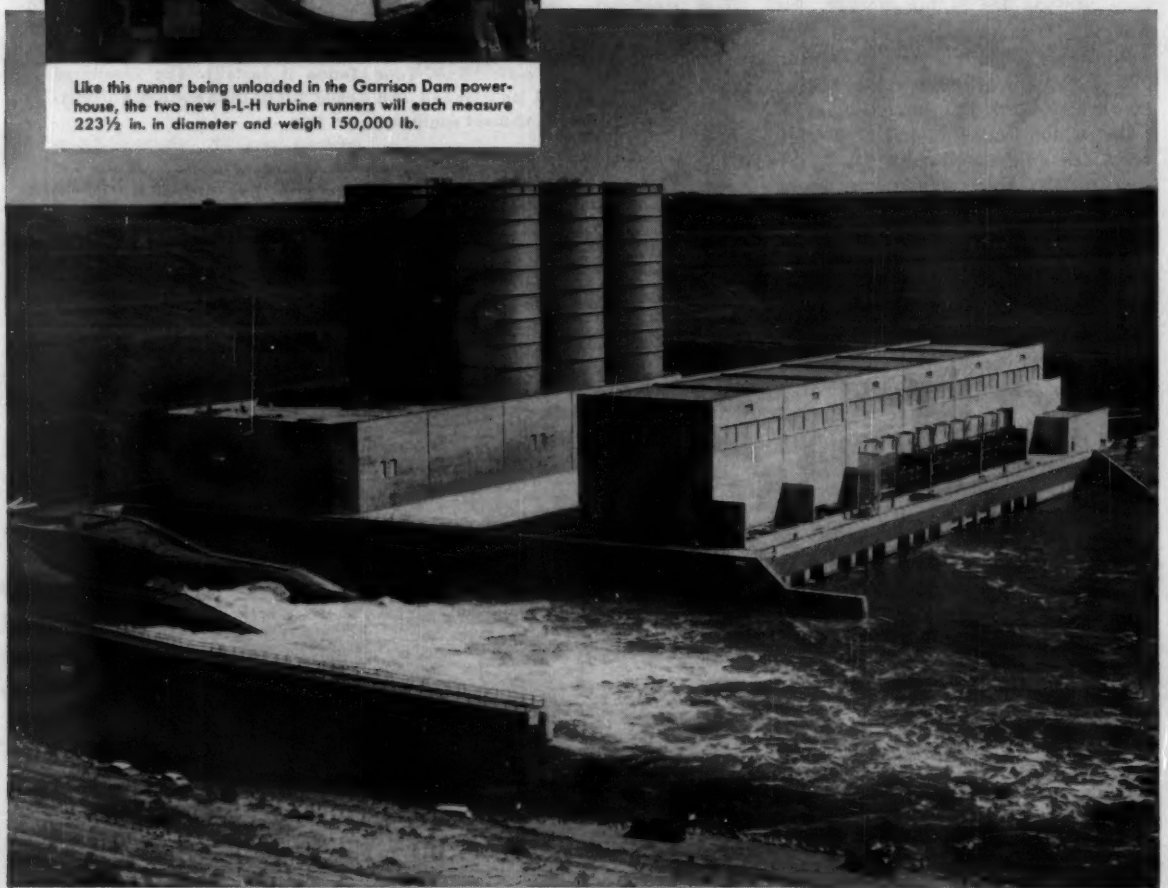


Like this runner being unloaded in the Garrison Dam powerhouse, the two new B-L-H turbine runners will each measure 223½ in. in diameter and weigh 150,000 lb.

With three of its huge Francis-type turbines already in operation at the Garrison Dam on the Missouri River at Riverdale, N.Dak., Baldwin-Lima-Hamilton is now building two more to be delivered in 1958 and 1959. Their installation will mark the completion of a project which encompasses the largest reservoir surface area in the world.

Each of these new B-L-H turbines will deliver 90,000 hp at 90 rpm under 150-ft. head. With all five B-L-H turbines in operation, Garrison Dam will be the source of enough electric power for a city of 1,200,000.

Baldwin-Lima-Hamilton is internationally recognized as the leader in design and manufacture of hydraulic turbines. For a copy of our illustrated Turbine Bulletin 1001, write to B-L-H Corporation, Philadelphia 42, Pa. or to Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



Powerhouse and surge tanks at Garrison Dam, under construction on the Missouri River. Included in work yet to be done is installation of two additional power generating units, the turbines for which are now being built by the Eddystone Division of Baldwin-Lima-Hamilton. Power output of this dam will be 450,000 hp.

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ELECTRICAL BUSINESS OUTLOOK

Electrical World
FEBRUARY 4, 1957

Manufacturing production costs will continue up this year, but not as much as last year. Wage increases will be the plus factor in the cost picture. Material prices should remain fairly stable. This is quite different from the situation that was shaping up a year ago. Last year both higher wages and higher material prices pushed costs up.

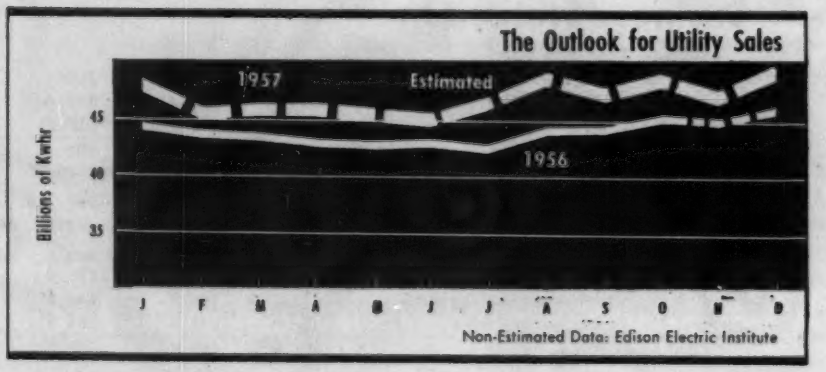
The push on costs from wage increases may seem odd at first glance. No really big contracts are open for negotiation this year. But the Bureau of Labor Statistics reports that 5 million workers are covered by contracts that call for automatic or cost-of-living increases. And cost-of-living eased up from 116.2 in June of '56 to 118.0 in December. This 1.5% gain in the index will dictate wage increases of varying amounts for certain workers in electrical manufacturing, steel, aircraft, chemical and aluminum industries early in the year. Other unions are due for increases later.

Wage hikes in '57 are not apt to be followed by a round of price increases like last year's. In many industrial lines capacity and demand are now in fairly close balance—steel, for instance. That will make for hard selling in 1957. And when businessmen are not pushing off would-be buyers, they have a strong incentive to hold the line on prices. Also, the smaller wage boosts expected this year can be absorbed in part by productivity increases.

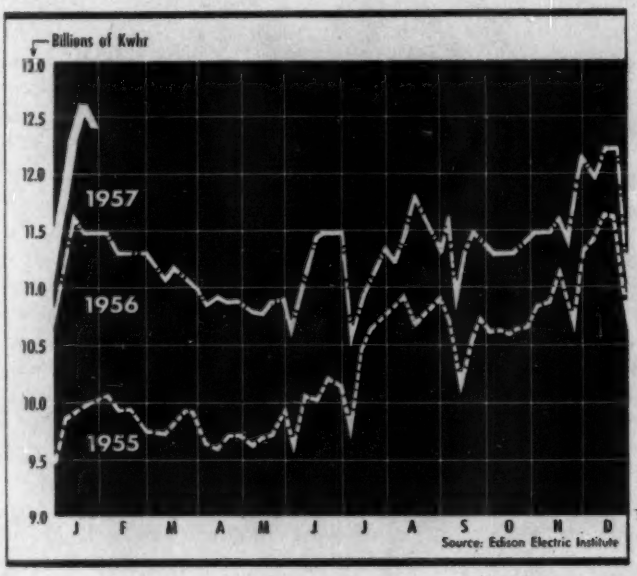
Electric companies will pay about $50 million more in wages this year than in 1956, if results of negotiations follow last year's pattern. Based on this assumption, hourly earnings will average about $2.34 for 1957 (vs $2.25 in '56), for an increase of 4%. Weekly earnings will average around $97.34 (vs $93.60 for a 41.6-hr week last year).

For comparison, manufacturing workers averaged $1.98 an hour in 1956. This is 5.3% more than the average two years ago. Their weekly pay was about $80.20.

Ike's stress on inflation dangers may slow the wage spiral down. In his economic report the President said, "Of particular importance in a prosperous economy is the responsibility of leaders of business and labor to reach agreements on wages and other labor benefits that are consistent with productivity prospects and with the maintenance of a stable dollar." Some observers have commented that unions must peg wage demands on rise of productivity. Otherwise, they and the businessmen who pass the cost on in the form of higher prices eventually face the prospect of added government rules and regulations.



STATISTICS



OUTPUT

Week ended Jan. 26, 12,410,000,000 Kwhr Up 7.8%

Per Cent Change From Previous Year

	Jan. 12	Jan. 19	Jan. 26
Total U. S.	+ 6.3	+ 9.0	+ 7.8
New Eng.	+ 4.6	+ 9.9	+ 6.5
Mid Atlantic	+ 3.3	+ 7.6	+ 4.8
Cent. Ind.	+ 6.3	+ 8.4	+ 5.9
West Cent.	+10.3	+10.6	+ 8.7
Southeast	+ 2.9	+ 8.2	+ 7.4
South Cent.	+12.1	+11.9	+11.5
Rocky Mount.	+11.0	+ 9.3	+12.8
Pacific			
NW	+ 9.9	+14.6	+16.8
SW	+11.2	+ 7.0	+ 9.0

Seasonally Adjusted Index 227.8
Week Ago 230.2
Year Ago 212.5

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 8.4%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Nov.	119.91	119.38	113.55	5.6
Peak—Class 1 Systems. (million kw)	Oct.	101.2	96.6	96.5	4.9
Estimated Dec. '56 Peak (million kw)	Nov.	106.2	106.2	104.5	1.6
Estimated Dec. '57 Peak (million kw)	Nov.	114.8	114.8	111.6	2.9
Production—billion kwhr	Nov.	50.65	51.13	47.78	6.0
Hydro		9.31	9.24	9.24	0.8
Fuel		41.34	41.89	38.54	7.3
Sales—billion kwhr	Nov.	45.78	45.98	42.96	6.6
Residential		11.66	11.27	10.74	8.6
Commercial		7.20	7.37	6.61	8.9
Industrial		24.51	24.79	23.28	5.3
Other		2.41	2.56	2.33	3.4
Fuel Consumption	Nov.				
Coal—million tons		14.03	13.52	13.31	5.4
Oil—million barrels		7.13	6.27	7.11	0.3
Gas—million cu ft		88.73	114.36	81.75	8.5
Net Income Class A & B Co's—$ million	Nov.	102.54	95.79	102.79	−0.2
Residential Customers—millions	12 mos.	45.62	45.49	44.30	3.0
Revenue per kwhr	ended	2.60¢	2.60¢	2.65¢	−1.9
Avg kwhr per customer	Nov. 30	2,956	2,942	2,728	8.4
Avg annual bill		$76.86	$76.49	$72.29	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Jan.	148.4	147.6	141.8	4.7
BLS Cost-of-living	Dec.	118.0	117.8	114.7	2.9
New Orders for Machinery (1950 = 100)	Nov.	140	139	143	−2.1
NEMA Sales					
Insulation materials	Nov.	149	163	155	−3.9
Electric appliances		81	94	88	−8.0
Wholesale prices	Nov.				
Motors and generators		140.1	136.9	127.0	10.3
Transformers and regulators		146.6	144.8	129.2	13.5
Switchgear and fuses		164.4	161.9	145.9	12.7
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

MANAGEMENT BULLETIN

FINANCE

Security offerings by electric utilities slowed down last week with only one offering coming to the market. This was the 580,613 common shares of Ohio Edison Co being offered to commonholders on 1-for-10 basis, record Jan. 31 to expire Feb. 15 at $46.50 a share (See p 19 for underwriting winner).

Louisville Gas & Electric Co is offering to stockholders, record Jan. 24 to expire Feb. 11, 330,000 common shares at $23.50 on the basis of one new share for each 10 shares. Unsubscribed stock will be bought by Blyth & Co—Lehman Brothers group . . . Western Light & Telephone Co is offering commonholders rights to 65,568 shares 5.20% convertible preferred stock at $25 a share. It is on a 1-for-8 basis, record Jan. 22 to expire Feb. 4.

New common stock rights offering for electric utilities are coming into the market at a high rate. Latest are: Southern Co plans to offer 1,507,304 shares around Mar. 13; Consumers Power Co, 549,324 shares about Mar. 6; Connecticut Light & Power Co, 927,598 shares on Feb. 11, and West Penn Electric Co, 528,000 shares on Mar. 14.

Consolidated Edison Co of New York will raise around $185 million in "new money" in the next two years, Vice President Charles B. Delafield told newsmen recently. This will include the $55 million 15-year convertible debenture issue to be offered around Feb. 26. This issue will be offered to the stockholders at the rate of $4 debentures for each share of common stock held. He hopes the rights will have a value of around 25¢ to 35¢.

Central & South West Corp will sell about $20 million of common stock (600,000 shares) sometime in March, Pres John S. Osborne told the New York Society of Security Analysts recently. He said that the system expects to spend $70 million this year as compared with $63 million in 1956.

Southwestern Public Service Co has disposed of electric and water facilities in Santa Rosa, N. M., which it acquired in 1946. Farmers' Electric Cooperative, Inc, Clovis, N. M., purchased the electric system. SPS will continue to operate it until completion of the co-op's 45-mi, 69-kv line from Fort Summer, N. M.

Georgia Power Co arranges to sell its surplus land acquired for the Sinclair reservoir near Sparta, Ga., which is not needed for the operation of the hydro plant to the Owen-Illinois Glass Co. Extent of the area has not been determined but will run into thousands of acres. Survey will be made.

TAXES

California legislature receives bill which would require publicly-owned utility districts to pay school taxes. Said Republican Assemblyman Sheridan Hegland, who introduced the measure, "if yardsticks are to be used on the merits of public power vs private power, then let's make the yardsticks comparable."

State Supreme Court of California is expected to rule within 90 days on appeal by San Diego County to require San Diego Gas & Electric Co to pay an additional $150,000 in taxes and interest. A lower court disallowed the charge, which would cover taxes on an integrated system rather than just that part of the system outside city limits.

PUBLIC RELATIONS

These electric companies have won the American Institute of Management rating of "excellent management" for 1956: Baltimore Gas & Electric Co, Boston Edison Co, Cleveland Electric Illuminating Co, Consumers Power Co, Detroit Edison Co, Ohio Edison Co, Pacific Gas & Electric Co, Tampa Electric Co, American Gas & Electric Co, Cincinnati Gas & Electric Co, Commonwealth Edison Co, General Public Utilities Corp, Iowa-Illinois Gas & Electric Co, Georgia Power Co, Kansas Power & Light Co, Arizona Public Service Co, Hart-

ford Electric Light Co, Columbus & Southern Ohio Electric Co, Consolidated Edison Co of New York, Texas Utilities Co, Virginia Electric & Power Co, Atlantic City Electric Co, Idaho Power Co, Pacific Power & Light Co, Union Electric Co, Toledo Edison Co, Southern Co, Southern California Edison Co, Niagara Mohawk Power Corp, Montana Power Co, Monongehela Power Co, and Iowa Power & Light Co.

Diamond and golden anniversaries are marked with booklets. American Gas & Electric Co issues a 28-page pamphlet entitled "Power—The Story of Electricity and a Region" to celebrate its 75th anniversary. . . . Hydro-Electric Power Commission of Ontario celebrates its 50th anniversary with special 44-page edition of its monthly news magazine.

LABOR **Southwestern Public Service Co inaugurates training program** to offer non-technical men opportunities for advancement in engineering department. After four months of training, men will be designated as engineer-estimators and take over time-consuming but basically non-technical work that has been handled by engineers in the past.

Nashville, Tenn., Power Board approves 4½% wage increase which will cost about $175,000 annually. Boosts range from 5 to 12¢ an hour.

YOUR HEALTH

Fainting: How Serious Is It?

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Have you ever "blacked out"? If it was only temporary, you probably have nothing to worry about. If it lasted for some time it may be due to a serious condition. Diabetes, kidney disease, heart disease, high blood pressure, hardening of the arteries, anemia, inflammation of the brain, all can cause unconsciousness.

A blow on the head can cause severe damage along with unconsciousness. Brain tumors, hemorrhages into the brain, heart attacks, acute sudden illnesses and drug poisoning may have loss of consciousness as one of their symptoms. Anyone with frequent or prolonged fainting spells should be carefully examined by his physician.

Some persons faint more easily than others. One may faint at the sight of blood, another because of nausea or pain or some emotional shock. Fatigue, an over-heated room, inadequate ventilation, standing too long in one position or getting up after a long period in bed can cause fainting.

Simple fainting is caused by lack of blood in the brain. A person does not faint when lying down. Fainting can come on suddenly, but except for cases that follow a physical blow, there usually are warnings. Discomfort and weakness, blurring vision, paleness of the face, squeamish stomach, and a cold clammy sweat are symptoms that precede a fainting spell. There may be dizziness and light-headedness. The pulse is first rapid then becomes slow. The blood pressure falls with loss of consciousness. If the faint persists for more than a few minutes, there may be muscular twitching and even involuntary urination.

A fainting person should be kept lying down with his feet elevated. If this is not possible, put him in a sitting position with the head lowered between his knees. Watch the color of the face. When the head is lowered the blood returns more quickly to the brain and the paleness disappears. Occasionally the face is flushed and in those instances keep the head raised. Artificial respiration is not indicated if the patient is breathing normally and not bluish in color.

Smelling salts, cold cloths to the face and the drinking of a few sips of aromatic spirits of ammonia all stimulate the fainting person.

He should be kept quiet until he has recovered his feeling of normal well-being. Do not permit him to walk about too soon. If the victim does not regain consciousness immediately, or if he falls into another faint, a physician should be called at once.

Some women think that it is a maidenly virtue to swoon during times of stress, but if you carry smelling salts around with you because you need them for frequent "swoons", you had better see your physician.

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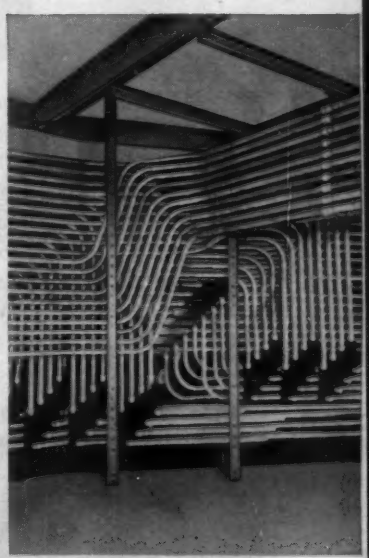
It will pay you to check further into the important cost advantages of Republic ELECTRUNITE E.M.T. It's produced to A.S.A. Specification C-80.3; Federal Specification WW-T-806; and carries the Underwriters' Laboratories Seal of Inspection. *Send for your free copy of 84-page ELECTRUNITE bending instruction booklet.*



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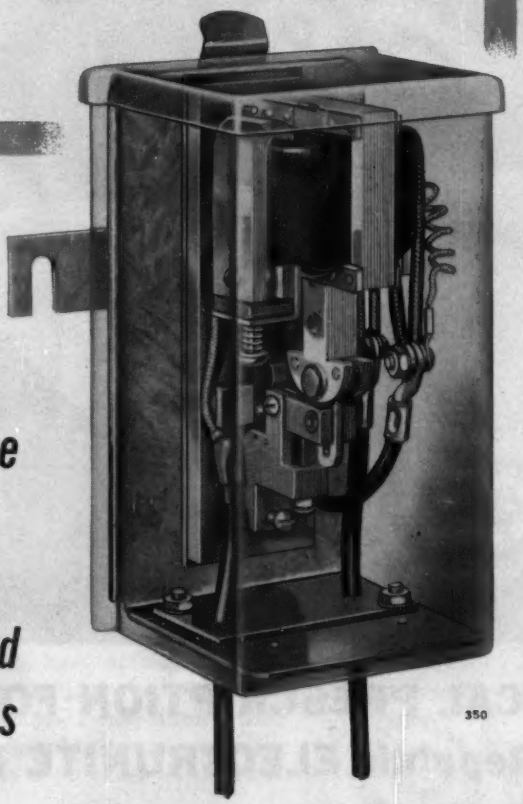

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SALES ASSIGNMENTS

COMPANY STAFFS

Four Wheel Drive Auto Co's Lloyd L. Pernot has been advanced from transport sales manager to director of sales engineering.

General Electric Co's Apparatus Division has designated Rodney C. Hardy as manager of user industries sales in the Columbus, Ohio, area. He replaces Mark Q. Allen, who has retired . . . New manager of the speciality resistor project at GE's metallurgical products department is Anthony J. Gizzi.

Miller Co has appointed Robert L. Kirshner as manager of advertising and sales promotion to succeed R. E. Owen, merchandising manager.

Minnesota Mining & Manufacturing Co's Russell E. Strawbridge is newly named sales supervisior for maintenance and construction trades, Electrical Products Division.

Reynolds Metals Co has announced the appointment of Richard L. Lukey as appliance market sales engineer of its Parts Division in Louisville, Ky.

Joseph T. Ryerson & Son, Inc, has named L. Paul Lee as manager of stainless steel sales at its Milwaukee plant.

Sylvania Electric Products, Inc, has appointed Chalmer J. Carothers, Jr, to handle national sales of mercury vapor lamps in addition to his other responsibilities as product sales manager of special lighting products . . . Carl S. Long, Jr, is new lighting sales manager of a newly established Rocky Mountain district with headquarters in Denver . . . Sylvania's Lighting Division has named John F. Dill as sales supervisor for the Milwaukee district office.

Thor Power Tool Co's Martin A. Bertram has been designated as manager of the new Great Lakes electric tool sales zone, with offices in Detroit.

REPRESENTATIVES

Automatic Switch Co has appointed Moore Brothers Electric Co of Flint, Mich., as authorized stocking distributors of Asco solenoid valves in the area. A similar appointment in the Melchor Ocampo, Mexico, area was made to Schultz & Cia., S.A.

General Electric Co's metallurgical products department has named Allied Carbide Products, Inc, as authorized Carboloy cemented carbide die products agent in the Hatboro, Pa., area.

Philco Corp's Government and Industrial Division has named the following representatives as part of its plans to inaugurate new national sales policies to market its paging equipment: George Voron Co, Philadelphia, Pa., to cover the area consisting of New Jersey, Delaware, and eastern Pennsylvania; and Cary Chapman & Co, Atlanta, to cover the southeastern states.

STEEL
213 E. 131ST STREET • CLEVELAND 8, OHIO
week
saved a ton of weight per thousand feet, resulted in lower building costs.

Coal Handling

(Continued from page 62)

cost curve it can be seen that at 350 TPH the cost will be 2.5¢ per ton; at 154 TPH, 5.7¢ per ton.

Aside from the method of selecting the machine on a production basis, there are other factors to be considered before buying. One of the first reactions will be: What about a standby machine? This is a valid consideration. There are very few installations without a second machine.

The machine or machines normally used must be large enough to supply the plant operating normally. From a cost standpoint, two machines, neither of which can supply the requirement, push unit costs up to where they become prohibitive. The addition of a second operator is, in itself, costly.

What type of standby machine should be selected? In most operations of this size it is a machine used previously on another property. It need not have the capacity of the machine in normal use. The downtime of the prime unit is not extensive. As a consequence, the standby machine is not subject to operation involving movement of the material over distances which the prime machine must work.

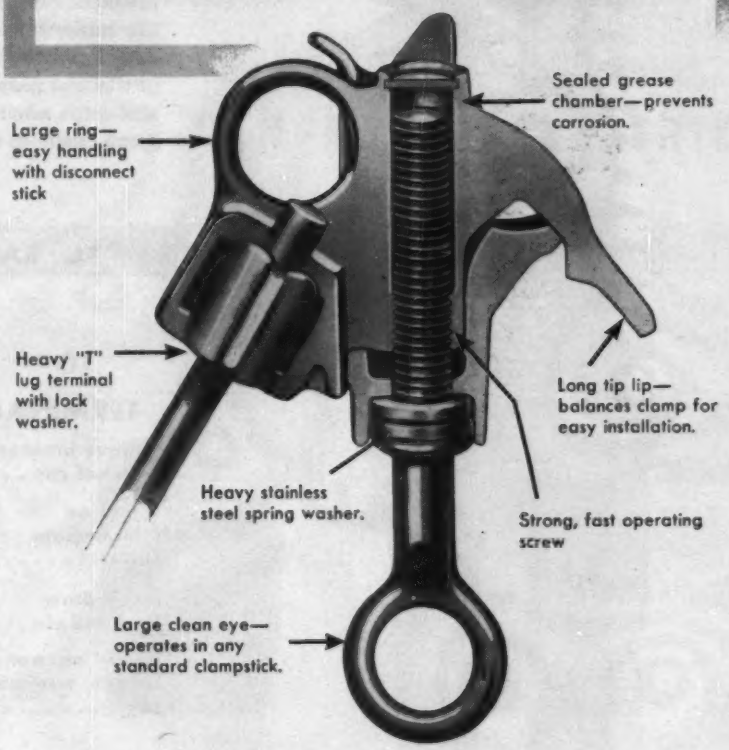
Smaller Tractor Performs Job

A second factor may involve building up storage before the plant begins operation. For such circumstances it may be possible to select a smaller tractor and lower unit costs of day-to-day coal moving. In the example just presented, this could be done. By selecting a smaller machine with owning and operating cost of $7.25 per hr, the cost of handling at the rate of 154 TPH becomes 4.7¢ per ton.

If storage were completely depleted, buildup with the smaller unit could be made at a slower rate, or a machine of larger capacity could be rented to stock at the initial rate of 350 TPH.

The surge area serves two purposes. First, it may be desirable to mix or dry the incoming coal. This is done by spreading the coal in thin layers on the surge pile before putting it into the plant. It can serve also as an area from which coal is taken without disturbing the permanent storage.

Tap tight, stay tight
...yet come off easy!
KEARNEY Protected Thread
CON-NEC-TAP CLAMPS


Sealed grease chamber—prevents corrosion.
Large ring—easy handling with disconnect stick
Heavy "T" lug terminal with lock washer.
Long tip lip—balances clamp for easy installation.
Heavy stainless steel spring washer.
Strong, fast operating screw
Large clean eye—operates in any standard clampstick.

High pressure contact under all conditions! Strong, double coil spring lock washer prevents loosening of Clamp . . . compensates for expansion and contraction of Clamp or conductor. Fully sealed in a grease filled chamber, the protected thread screw can't corrode. No matter how long they've been on the line, you never have to cut KEARNEY Con-nec-tap Clamps from the conductor. They're easily removed . . . ready for re-use!

351

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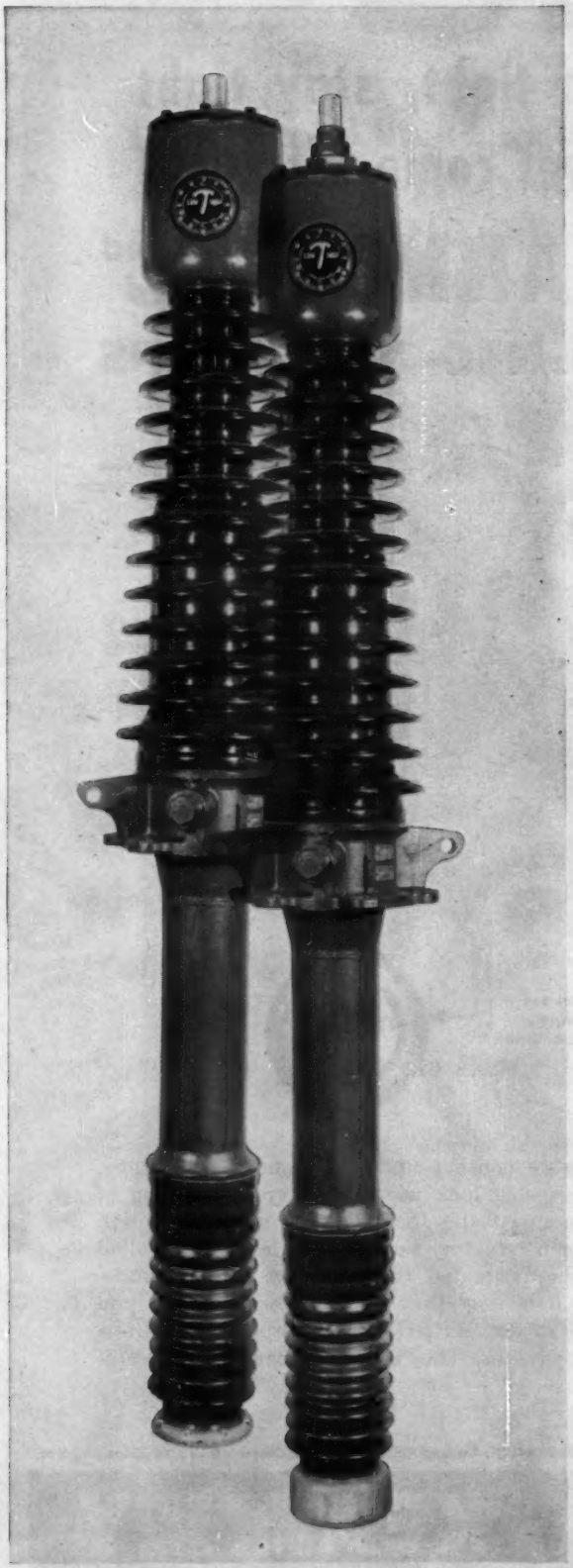
Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.



This new

. . . and drastically reduces your bushing inventory

In ratings from 92- to 230-kv, General Electric will now supply, on most of its power transformers and circuit breakers, bushings which lead two lives. These double-life bushings, interchangeable between transformers and circuit breakers, result from G.E.'s encouragement of the new proposed ASA standards for bushings . . . standards which will materially reduce the quantity of spare bushings needed for stock.

TO EASILY CONVERT CIRCUIT

TOP TERMINAL

remove breaker terminal cap . . ❶

screw on intermediate cap . . . . . ❷

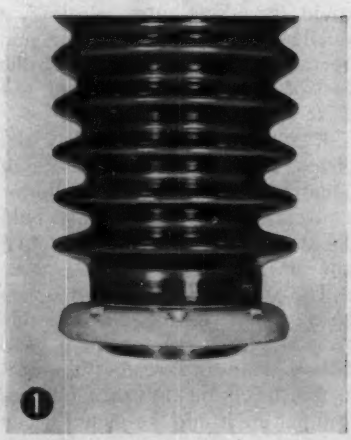
insert draw lead and pin . . ❸

screw on transformer terminal cap . . . . . ❹

BOTTOM TERMINAL

unscrew bottom ring . . . . ❶ & ❷

replace with static shield . . ❸ & ❹



DOUBLE INDENTITY of new 92-230-kv General Electric standard bushings is represented by this double exposure of a single 115-kv bushing, suitable for use on either a power transformer or circuit breaker.

bushing leads two lives

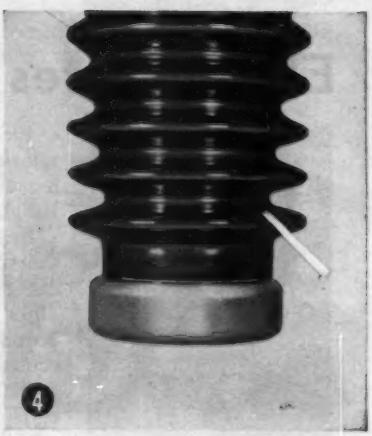
In each voltage class, bushings are available which are completely interchangeable between transformers and circuit breakers produced by all manufacturers adopting the proposed standards. The changeover from circuit breaker application to transformer, or vice versa, can readily be made in minutes without special tools. Photos below show how the conversion can be made simply by changing top and bottom terminals.

For more than two years, General Electric has been helping you reduce your bushing inventories by providing ASA standard bushings on power apparatus rated 23- to 69-kv. Now, with G.E.'s new standards in the 92- to 230-kv range, you can realize even greater savings by specifying G-E power transformers and circuit breakers. For more information, contact your nearest G-E Apparatus Sales Office or write Section 422-40, General Electric Company, Schenectady 5, New York.

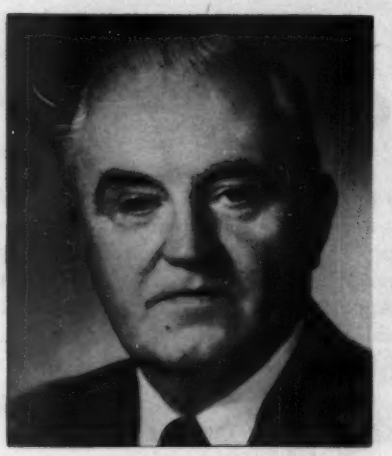
Progress Is Our Most Important Product

GENERAL ELECTRIC

BREAKER BUSHING TO SECOND LIFE FOR TRANSFORMER USE . . .



NEWS ABOUT PEOPLE



Paine Named Superintendent

Portland General Electric Co has named E. A. Paine superintendent of distribution.

His former duties as assistant to the superintendent of distribution were taken over by Scott Samsel. Another change in the PGE organization promoted Robert H. Short from manager of public information to assistant to the chairman of the board of directors.

Paine has been employed by Portland General Electric Co since 1917 when he graduated from Oregon Agricultural College with a degree in electrical engineering. He held various posts in the valuation and distribution departments before being upped to distribution engineer in 1941. Paine was appointed assistant superintendent of distribution in 1948.

E. A. PAINE

Promotions at RCA Advances Three Officers

Radio Corporation of America has recently elected Frank M. Folsom chairman of the executive committee of the board; John L. Burns, president and a director; and Dr Douglas H. Ewing, vice president of research and engineering.

Folsom, who has served as president of RCA since 1949, suggested that his successor be named now to facilitate the transition in management when he retires in two years. He joined RCA in 1944 as a director and vice president in charge of the RCA Victor Division and became executive vice president of the division in 1945.

Burns had previously been a senior partner and vice chairman of the executive committee of the management consultant firm of Booz, Allen and Hamilton, which he joined in 1941.

Dr Ewing joined RCA in 1945 as manager of the Teleran engineering section of the RCA Victor Division. He was later advanced to vice president of RCA laboratories in 1955, a post he held until his present appointment.

FRANK M. FOLSOM

JOHN L. BURNS

DR DOUGLAS H. EWING

ETL Promotes Beagle

HOFFMAN S. BEAGLE

Electrical Testing Laboratories, Inc, of New York has elected Hoffman Stone Beagle as president.

Beagle, a veteran of 29 years service in the electrical field, joined ETL in 1953 as assistant to the president and became executive vice president in 1956. Beagle formerly was employed by General Electric Co, Niagara-Mohawk Power Corp, Railly Corp, and the Miller Co.

Lundquist Made VP

Adolph Q. Lundquist has been appointed a vice president of Union Carbide Nuclear Co, a division of Union Carbide & Carbon Corp.

He joined Union Carbide in 1942 as assistant superintendent of operations of U.S. Vanadium Corp, the Division of Union Carbide that was succeeded by Union Carbide Nuclear. He became general manager, Colorado Plateau, in 1955.

ADOLPH Q. LUNDQUIST

Electric Bond & Share Elects Quig

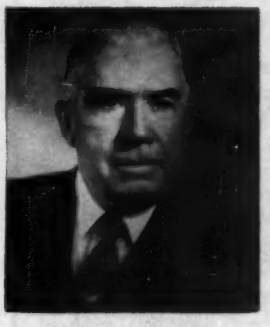
ROBERT S. QUIG

Robert S. Quig has been placed in charge of the rate department of Ebasco Services, Inc. He succeeds L. R. Lefferson who retired from that post on December 31.

Quig joined the rate department of Electric Bond and Share Co in 1930 as an assistant rate engineer. He advanced later to assistant head of the department.

In his new position, Quig will have supervision of the consulting services which the rate department renders to electric, gas, and other utilities.

Quig is a graduate of both Iowa State College and the Harvard School of Business.



PAUL V. GALVIN

ROBERT W. GALVIN

DANIEL E. NOBLE

ARTHUR L. REESE

Motorola, Inc, Announces Four Management Promotions

At a recent meeting of its board of directors, Motorola, Inc, announced four management promotions.

Paul V. Galvin was elected chairman of the board and was succeeded as president by Robert W. Galvin, formerly executive vice president.

Daniel E. Noble, formerly vice president, was named executive vice president in charge of the redesignated Communications and Industrial Electronics, Semi-conductor Products, and Military Electronics Divisions.

Arthur L. Reese was advanced from general manager of the former industrial electronics and communications products department to vice president and general manager of the new Communications and Industrial Electronics Division.

Noble and Reese will continue to serve in their present capacities as vice president and general manager, and vice president and operations manager, respectively, of Motorola Communications and Electronics, Inc, the wholly owned industrial sales subsidiary.

The board also gave approval for establishment of five new major product divisions — Consumer, Automotive, Industrial, Semi-Conductor, and Military Products.

PERSONAL BRIEFS

Southwestern Gas & Electric Co has named **John W. Turk** to the newly created post of nuclear development engineer . . . **Vernon C. McFarland** becomes manager of new business department, Louisiana Division.

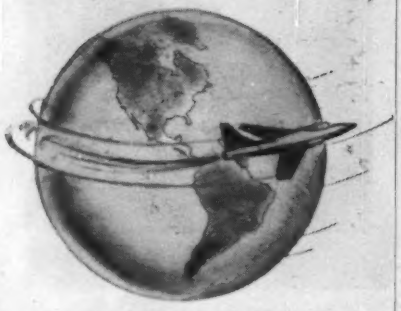
S. G. Page, former labor relations manager, has been appointed director of personnel for Duquesne Light Co and subsidiaries . . . Newly named superintendent of general property for Arizona Public Service Co is **Robert L. Franklin,** former superintendent of transportation.

Quentin Q. Quinn has been named to succeed the late **Howard W. Memmott** as industrial sales manager of Connecticut Light & Power Co. **Robert S. Bromage,** continuing at rate engineer, has been appointed assistant to CL&P's sales vice president **A. M. Wade.**

Carolina Power & Light Co's **Frank T. Scarborough** has been named manager of the Zebulon (N. C.) office to replace **Ralph Tarlton,** who has transferred to Rockingham. **William B. Kincaid** has joined the production group of CP&L's operations and engineering department as senior engineer . . . Commonwealth Edison named **Arthur D. Gaskey** assistant manager of engineering.

(More Personal Briefs on page 110)

AROUND YOUR WORLD



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at the

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13TH INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

480 Lexington Avenue
New York 17, N. Y.

Management: International Exposition Co.

Personal Briefs

(Continued from page 109)

Federal Power Commission has appointed **Edgar T. Hughes** as chief of the Bureau of Power's Division of Electric Resources and Requirements. He succeeds **Claudius E. Bennett,** who retired Feb. 1.

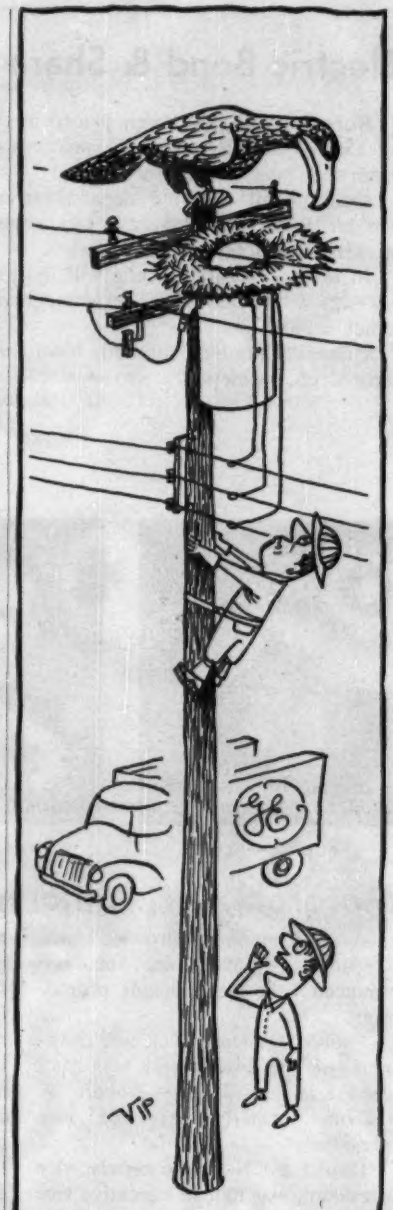
Newly elected president of Oklahoma Utilities Association is **H. P. Hoheisel,** advertising and publicity manager for Oklahoma Gas & Electric Co.

Graybar Electric Co has named **J. P. McCarthy** and **F. C. Sweeney** as managers at its Newark (N. J.) and Queens Plaza (N. Y. C.) location, respectively. **N. F. Clark** becomes operating manager at Queens Plaza.

Robert K. Allen is new superintendent of production development at Babcock & Wilcox Co's Alliance, Ohio, Research Center . . . Foster Wheeler Corp has designated **Kenneth S. Brundige** as manager of its condenser department.

Clifford M. Foust has retired after 35 years as a General Electric Co engineer. Foust, 1935 recipient of GE's Charles A. Coffin Award, represented the U. S. on the high voltage committee of International Electrotechnical Commission in 1947 and served as a member of the International Conference on Large Electrical Systems . . . GE's instrument department has named **Laurence L. Hartdorn** as manager of instrument transformer sales. He succeeds **James A. Yunker** who transfers to the firm's Transformer Division . . . **Charles J. Meloun** is new manager of engineering of GE's outdoor lighting department. He replaces **H. J. Flaherty** who has been named consultant . . . Recently named general manager of GE's distribution transformer department was **Marc A. deFerranti,** former head of the company's "university for managers" at Crotonville. He succeeds **Raymond W. Smith,** now general manager of the Transformer Division.

Edward M. Imhoff has been elected treasurer of Pioneer Service & Engineering Co, succeeding **Raymond F. Linehan,** deceased.



"Hurry, Smedley, you know G.E.'s reputation for fast transformer repair!"

Need distribution transformers uprated fast? Call a General Electric Apparatus Service Shop. The shop can uprate your old transformers in both kva and voltage for about two-thirds the cost of new transformers . . . can also convert to self-protected type. And you get new-transformer warranties. Call your G-E Apparatus Service Shop or Sales Office. 431-54

Progress Is Our Most Important Product

GENERAL ELECTRIC

S&C Electric Co has named **R. W. Hutchinson** as manager of its newly formed Western Sales Division. Hutchinson was formerly with Federal Pacific Electric Co and Westinghouse Electric Corp.

Recently named as sponsors of National Engineers' Week, Feb. 17-23, were **Charles F. Kettering,** General Motors Corp; **Clarence H. Linder,** General Electric Co; **Thomas E. Murray,** Atomic Energy Commission; **Phillip Sporn,** American Gas & Electric Co; **Vannevar Bush,** former president, Carnegie Institution of Washington; **Allen B. DuMont,** Allen B. DuMont Laboratories, Inc; **James R. Killian, Jr,** Massachusetts Institute of Technology; **Royal W. Sorenson,** California Institute of Technology; **David B. Steinman,** consulting engineer; **Charles A. Thomas,** Monsanto Chemical Co; and **Robert E. Wilson,** Standard Oil Co of Indiana.

Kaiser Engineers International, Inc, has appointed **Wright M. Price** resident manager of construction and **R. J. Price** will handle coordination of the Asunicon project as assistant to **Jack Hughes,** vice president of KEI.

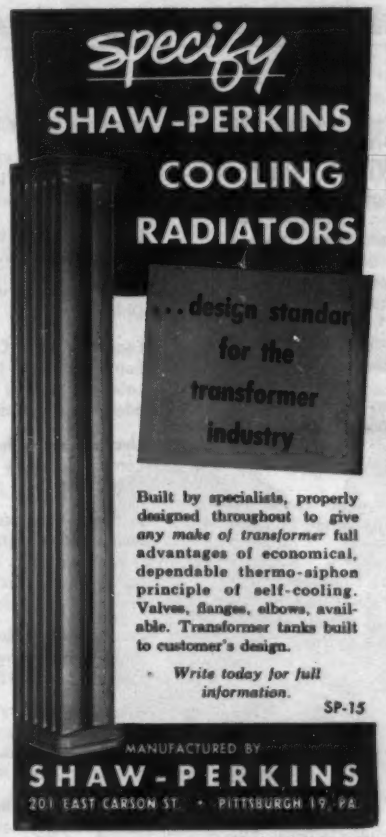
Dean Shepherd has been appointed purchasing agent of Allis-Chalmers Manufacturing Co's Terre Haute (Indiana) Works, succeeding **R. W. Peterson,** resigned. **E. H. Bartelt** has become assistant purchasing agent.

York-Hoover Corp has appointed **William E. Ciccarelli** as director of research and development of the Body Division.

American Steel & Wire Division of the United States Steel Corp has designated **Walter L. Longnecker** as Cleveland district manager of operations.

Holan Corporation of Georgia has elected **Robert R. Rector** sales vice president.

Appointment of **Henry O. Wolcott** as chief engineer and production manager for the Instrument Division of Federal Telephone & Radio Co, a division of International Telephone & Telegraph Corp, has been announced.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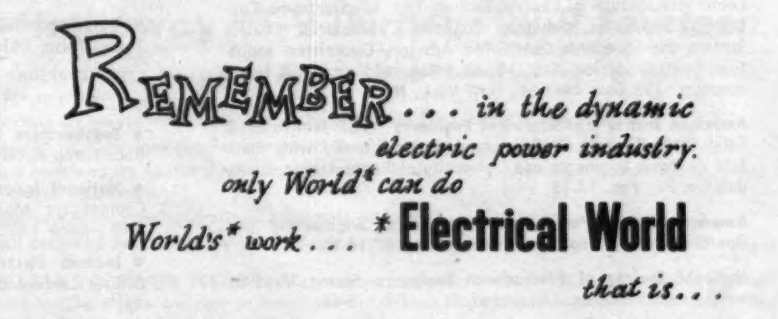

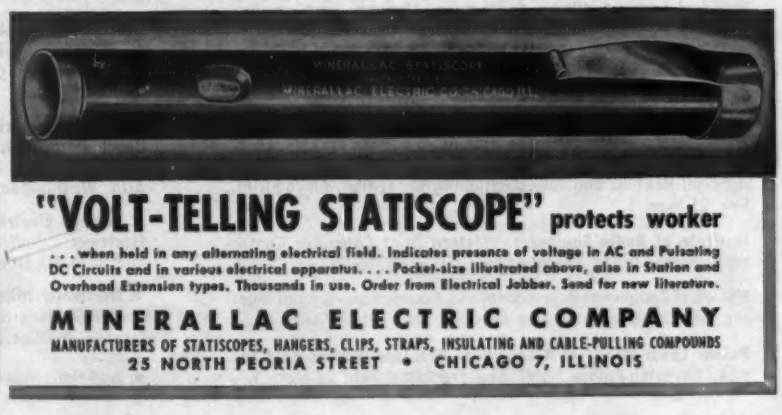
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MEETINGS CALENDAR

FEBRUARY

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

• **Edison Electric Institute**—Commercial Lighting Committee, St. Louis, Mo., Feb. 4-5; Dealer Coordination Committee, New Orleans, La., Feb. 4-5; Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; HOUSEPOWER Pittsburgh Workshop, Pittsburgh, Pa., Feb. 5; Electrical Space Heating and Air Conditioning Committee, St. Louis, Mo., Feb. 6-8; Street Lighting Committee, Washington, D. C., Feb. 6-7; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Residential Lighting Committee, Cincinnati, Ohio, Feb. 11-13; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Ala., Feb. 14-15; Residential Promotion Committee, New York, N. Y., Feb. 14-15.

American Society for Testing Materials—Annual Committee Week and Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 4-8.

Pennsylvania Electric Association—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee and Systems Operation Committee, Benjamin Franklin Hotel, Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference and Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

National Electrical Manufacturers Association—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuits Conference, sponsored jointly with institute of Radio Engineers and University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

American Public Power Association—First Engineering and Operations Workshop, Springfield, Mo., Feb. 14-15.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

Cleveland Electronics Conference—Masonic Auditorium, Cleveland, Ohio, Feb. 15-16.

National Adequate Wiring Conference—13th Annual Discussion, Sherman Hotel, Chicago, Ill., Feb. 21-22.

North Central Electrical League—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28; 13th International Heating and Air-Conditioning Exposition, Chicago, Ill., Feb. 25-Mar. 1.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

Electrical Equipment Representatives Association—Annual Meeting, St. Anthony Hotel, San Antonio, Tex., Feb. 27-Mar. 2.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

National Rural Electric Cooperative Association—Annual Meeting, Conrad Hilton Hotel, Chicago, Ill., Mar. 4-7.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

Street Tree and Utility Conference—Hotel Cleveland, Cleveland, Ohio, Mar. 7-8.

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

Electric Companies Public Information Program—Inter-Regional Committee, New York, Mar. 12; Steering Committee, New York, Mar. 14.

National Electrical Manufacturing Association—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

Institute of Radio Engineers—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

American Society of Mechanical Engineers—Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, William Penn Hotel, Pittsburgh, Pa., Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Electric Meter Institute—Eighth Annual Session, University of Denver, Denver, Colo., Mar. 25-29.

• **Oklahoma Utilities Association**—Annual Convention, Hotel Tulsa, Tulsa, Oklahoma, Mar. 28-29.

APRIL

• **Southeastern Electric Exchange**—24th Annual Conference, Boca-Raton Hotel and Club, Boca Raton, Fla., April 1-2.

• **National Industrial Conference Board**—8th Atomic Energy Courses for Management, Westchester Country Club, Rye, N. Y., April 1-6.

• **Indiana Electric Association**—17th Annual Young Men's Utility Conference, Terre Haute House, Terre Haute, Ind., April 3-4.

• **Missouri Valley Electric Association**—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

• **Northwest Public Power Association**—Annual Membership Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 3-5; Engineering and Operations Section, Tacoma Utility Center and Winthrop Hotel, Tacoma, Wash., April 23-24.

• **Edison Electric Institute**—Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; National Accounting Conference of Electric & Gas Utility Accountants, held jointly with AGA, Washington, D. C., April 8-10.

• **Eastern Electrical Wholesalers Association**—Fourth National Electrical Industries Show, 71st Regiment Armory, Park Ave, and 34th St., New York, April 8-11.

• **Northeast Missouri Electric Power Cooperative**—Eighth Annual REA Generating Plant Operation and Maintenance Conference, Phillips Hotel, Kansas City, Mo., April 8-11.

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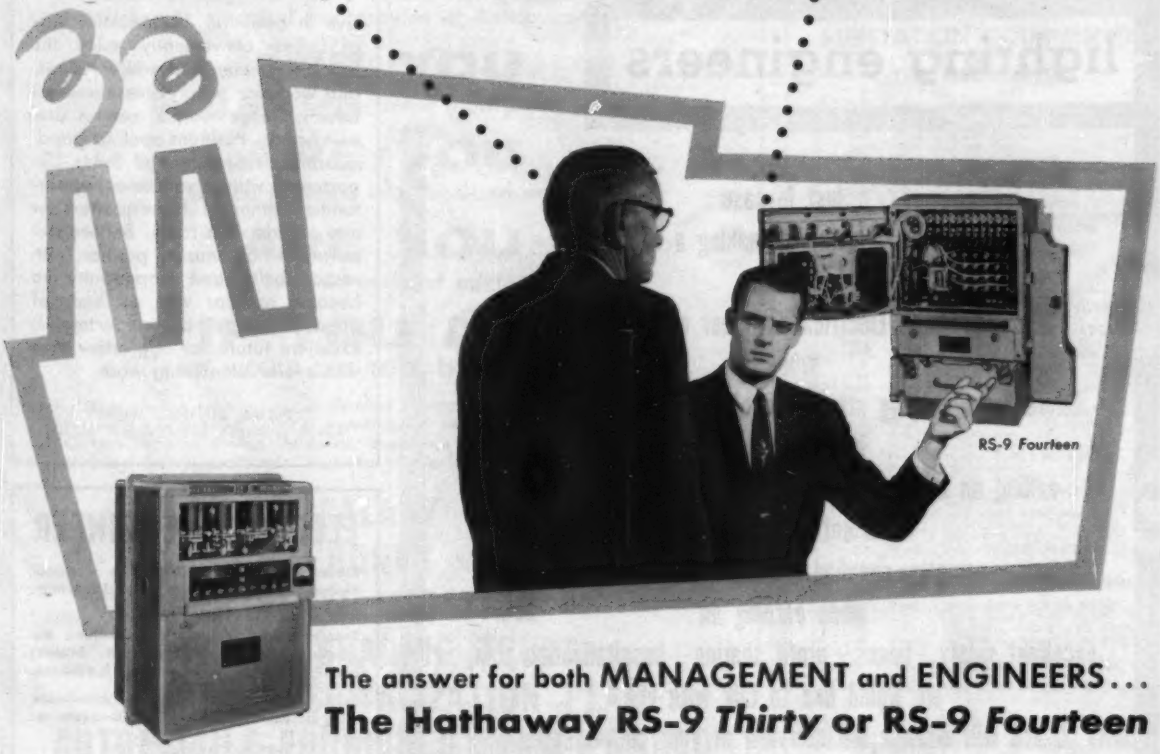

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3	1500	Wag.	44,000-6900/11950
3	1250	A.C.	44,000/11500-460
3	75	West.	44,000-7200/12470Y
3	5000	G.E.	38100/66000-6600
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4	3125	Mol.	39900/69000Y—26600/46000Y
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3	667	A.C.	33,000—2400/4160Y
3	500	West.	34,400—13,800
4	333	Kuhl.	33,000—7200/12470Y
3	200	A.C.	34,500—2400/7200/12470Y
3	75	Wag.	33,000—240/480
1	3000	A.C.	23,380—2500/4330Y, 3 Ph.
3	2000	A.C.	26,400/13,200—2390/4140
3	1000	G.E.	23,310—2500/7500/12990Y
3	100	G.E.	22,000—7200/12470Y
3	50	G.E.	22,000—2300
2	3000	G.E.	13,800—600, 3 Ph. Unit Sub.
3	1667	G.E.	13,800—600
3	1200	West.	13,800—600, 3 Ph. Unit Sub.
1	1000	West.	13,200—2300, 3 Ph. Unit Sub.
1	1000	A.C.	13,800—480, 3 Ph.
1	600	Stand.	13,200—2300, 3 Ph.
1	450	Penna.	13,200—2400, 3 Ph. Askarel
3	200	G.E.	13,200—2400
3	50	West.	13,750—125/250
1	2500	A.C.	11,000—2400/4160Y, 3 Ph.
3	125	A.C.	6900—2300
3	500	West.	2400/4160Y—240/480
3	150	West.	2400—230/115
1	100	G.E.	2300—575, 3 Ph.
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Johns-Manville

Duxseal

in the new handy pocket roll

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The NEW pocket roll container allows quick removal and replacement of the compound. Its ribbon form makes Duxseal easy to apply in any amount, large or small.

3 types of Duxseal are now available in pocket rolls:

- **STANDARD DUXSEAL** is a permanently plastic gray-green compound utilizing a non-drying, vegetable-oil vehicle. It will not corrode metals, plastics, wood, rubber, or painted surfaces. It adheres well to all common materials. It is non-staining.
- **TYPE N DUXSEAL** has the same properties plus higher resistance to bleeding or dripping at high temperatures.
- **R-100 DUXSEAL** employs a resinous material as its vehicle and has the same properties. It skins fast to provide an excellent paint surface.

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DUXSEAL

Trenching. This 'Jeep'*-propelled trencher unit digs up to 800 feet of clean-cut trench per hour, to speed the installation of cable, conduit and service lines. With the accelerating trend to underground lines, the 'Jeep'-trencher unit becomes increasingly important in electrical industry service.

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Versatile "go-anywhere" 'Jeep' vehicles help assure uninterrupted, 'round-the-clock electrical service.

They have the all-wheel traction to go almost anywhere, to serve on job after job 24 hours a day. These rugged vehicles reach out-of-the-way line installations or patrol the right-of-way, in good weather or bad—wherever line service or maintenance is needed.

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Rugged 'Jeep' vehicles are functionally designed to withstand the toughest use...spread their cost over hundreds of different jobs from stringing high lines to installing meters. And their low upkeep, long life and high resale value provide extra savings. See your Willys dealer for an on-the-job demonstration today.

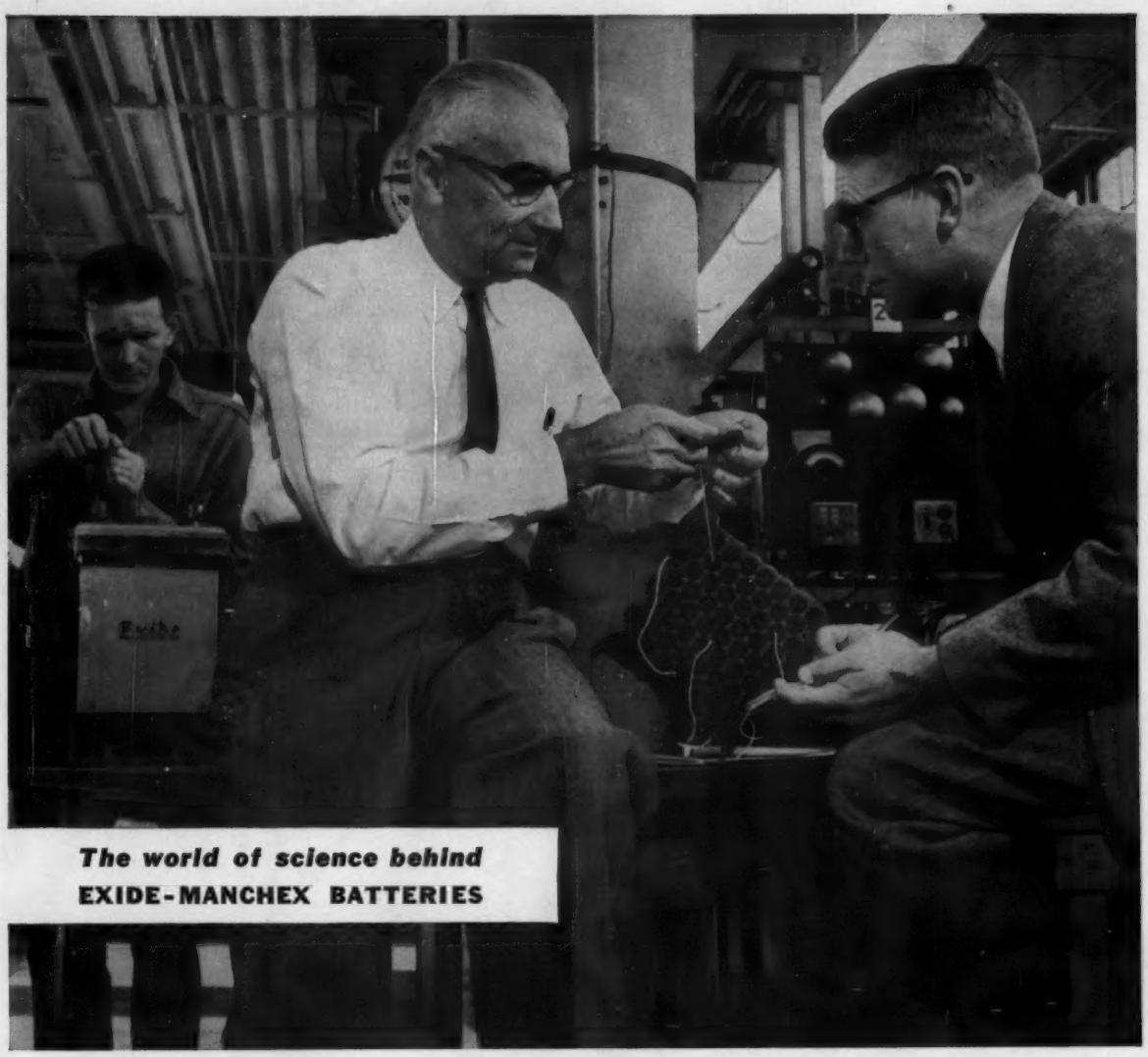
The 'Jeep'®

family of 4-Wheel-Drive vehicles

WILLYS... makers of the world's most useful vehicles

*Model CJ-5 shown

WILLYS MOTORS, INC., TOLEDO 1, OHIO

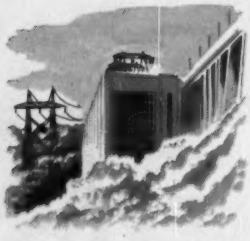


The world of science behind
EXIDE-MANCHEX BATTERIES

Being interviewed is R. R. Jardine, Supervisor of Development Engineering

"Open windows let electrolyte in—power out"

At the Exide Laboratories—**Reporter:** You mean there's an important connection between the electrolyte and the battery power?



Jardine: Yes indeed. You see how I'm running these strings through the "windows" in the Exide-Manchex positive plate? These openings give the electrolyte free access deep into the interior of the plate.

Reporter: How does that affect battery performance?

Jardine: It means there's no time lag—no slow filtering of the electrolyte to reach the active material. There's a continuous contact between the electrolyte and the entire plate. So the power is there when it's called for.

Reporter: Do other batteries have this free access of electrolyte to the active material?

Jardine: No they don't. Because only the Exide-Manchex has the positive plate with the spiral lead buttons locked into a cast alloy grid.

Reporter: Obviously this is an important feature of the Exide-Manchex Battery.

Jardine: Yes it is, but it's just one of many engineering details that contribute to their long life and high capacity.

Note to battery users: When you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide**

Compare Cost of Regulators and LTC Transformers

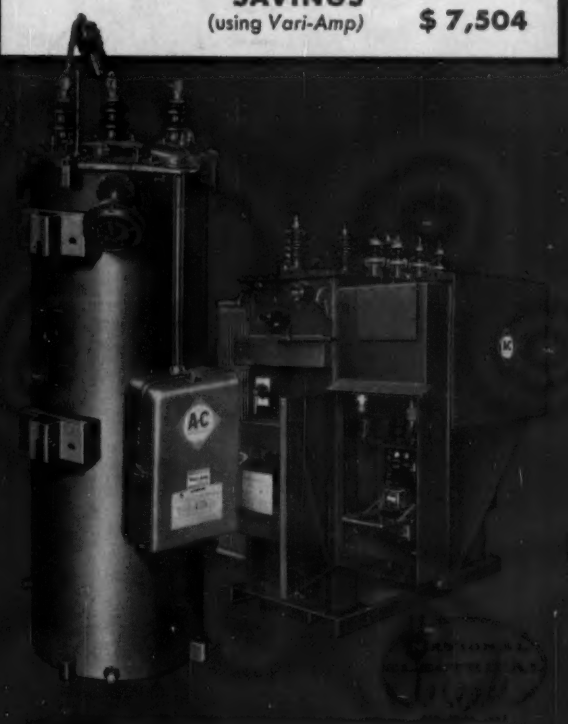
Regulators save $7,504

Here are the four steps needed to make this comparison:

1. Select substation size.
2. Determine percent regulation required.
3. Select proper size regulating unit, based either on current or kva, and range of regulation required.
4. Compare cost of LTC portion of transformer and 3 distribution regulators.

In this example, the substation size is 7500 kva, 328 amperes, 13,200 volts, self-cooled. Regulation required is +10% −5%.

LTC on transformer with ±10% regulation - - - -	$19,174
3 Distribution Regulators with +10% −5% regulation - -	11,670
SAVINGS (using *Vari-Amp*)	$ 7,504



Key to savings is *unequal* range of regulation using *Vari-Amp*

Regulation needs are figured either on basis of setting permanent taps of transformer up 5%; or using an alternate voltage on low voltage winding to provide a 5% boost.

Then only a 5% raise from the regulator is needed. On maximum load the transformer raises voltage 5%; regulator raises voltage 5% . . . a net raise of 10%.

This requires regulators to carry 7500 through kva or 328 amperes at the 5% *Vari-Amp* position.

On minimum load the transformer raises voltage 5%; regulator lowers voltage 10%, which gives a net result of −5%. The regulator is allowed to go to −10% because load current has dropped below the 10% current rating of the regulator.

The selection: regulators rated 167 kva, 7620 volts, 219 amperes.

Comparing costs shows a saving of $7504 using Allis-Chalmers distribution regulators with *Vari-Amp*.

Allis-Chalmers Originators of:
- 5/8% step regulators
- Unit construction
- *Vari-Amp*

See what you can save!

Get a bid on A-C regulators next time you figure a substation. Ask your nearby A-C office or write for "Key to low cost regulation," No. A-5307. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5297

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